The Welding Engineer

Reg. U. S. Pat. Office

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The parts and the finished product

Do pressing production problems permit of wasted energy?

Taking ten minutes to make welds that should require but six is wasting time and energy.

You'll soon be called upon to supply some mighty big markets. The problem is to get your goods into the hands of your customers promptly.

TORCHWELD APPARATUS eliminates old-time troubles such as flashing, oxidized welds, frequent calls for repairs and excessive gas consumption.

It's time to expect a departure from the old way of doing things. The TORCHWELD WAY will add a new impetus to your production departments.

Reduce your welding department worries. You can then go after other problems all the harder.

Half-way measures will never do. We can help you meet the rapidly changing conditions of today

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Fulton and Carpenter Streets CHICAGO

High-grade welding and cutting apparatus. Portable or generator outfits. Welding materials, fluxes, supplies and accessories

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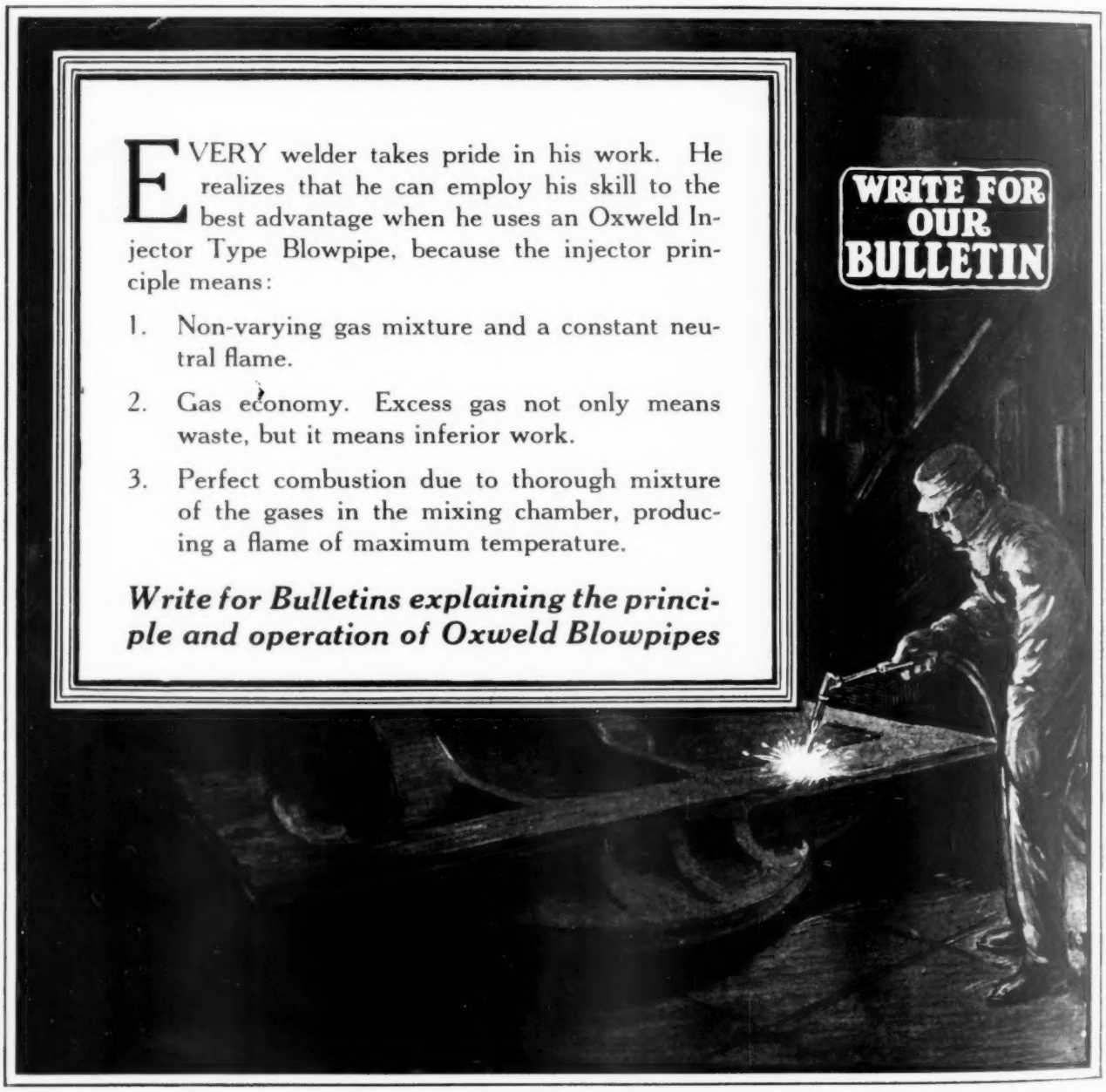
EVERY welder takes pride in his work. He realizes that he can employ his skill to the best advantage when he uses an Oxweld Injector Type Blowpipe, because the injector principle means:

1. Non-varying gas mixture and a constant neutral flame.
2. Gas economy. Excess gas not only means waste, but it means inferior work.
3. Perfect combustion due to thorough mixture of the gases in the mixing chamber, producing a flame of maximum temperature.

Write for Bulletins explaining the principle and operation of Oxweld Blowpipes

WRITE FOR OUR BULLETIN



OXWELD ACETYLENE COMPANY

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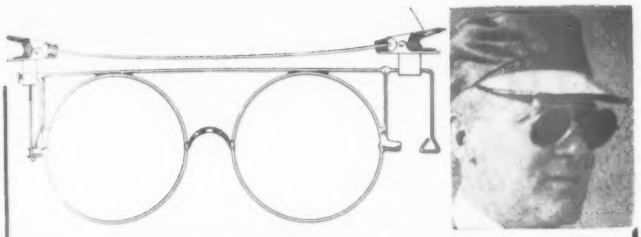

The Histed Novelty Goggle

FOR WELDERS

is attached to the welder's cap by means of two little spring clips that clamp to the visor of the cap and hangs clear of the face, thus avoiding the possibility of the face or nose being blistered by the hot metal touching the skin. The lenses are 2 inches in diameter, which gives ample eye protection and prevents the welder looking past the lens when welding overhead. Good ventilation is assured by the Goggle not being enclosed and admitting plenty of light, thus keeping the eyesight normal at all times—that is, not dilated as in enclosed Goggles. No moisture from perspiration can gather on lenses, thus keeping vision clear, adding materially to the welder's efficiency. When inspecting work, the Goggle may be swung to a raised position and back quickly, without loss of time at welding, or removing gloves, or laying down torch or welding rod—a great advantage over those using the elastic head-band or ear-bows. When Goggles are not in use they are swung to a raised position and held in place by spring, and may be worn on cap visor at all times without inconvenience. They are always ready and stay nicely in place, whether welding down or overhead.

Patent Allowed—April 3, 1919.

The Goggles are supplied with the "Willson Industro Lenses" in any degree of density desired. Practical welders can't speak too highly of the

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Sent to any address in the United States for
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$24.00 per Dozen.

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Preheating with a Hauck Burner distributes expansion stresses uniformly. Reduces time and cost of welding by using a cheaper fuel to bring metal to a red heat before actually welding. Also permits welding to be done in place without dismantling equipment.

Ask for Preheating Booklet 93.

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Prices—Right
Delivery—From Stock

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have been developed with the growth of the Welding Process, having been on the market since welding was in its infancy, and the constantly increasing demand for these supplies is the best testimonial that can be offered.

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2 All accessories and supplies of the best quality.

3 The most completely equipped welding shop in New York City and capable of handling the largest castings or any quantity of manufacturers work—men and apparatus supplied for outside work.

4 A large stock of acetylene and Oxygen always on hand to supply our trade at the lowest market prices.

5 Everything needed for oxy-acetylene work we supply.

K-G Welding & Cutting Co.

Incorporated

556 West 34th St., New York City

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

ACETYLENE (Compressed in Cylinders)
Commercial Acetylene Welding Co.
Universal Oxygen Co.
Prest-O-Lite Co.

ACETYLENE CYLINDERS

ACETYLENE GENERATORS
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Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co
United States Welding Co.

ALUMINUM FILLER RODS
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Bermo Supply Co.
Burdett Oxygen Co.
Central Steel & Wire Co.
Davis-Bournonville Co
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Hauck Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Mach. Co
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

ALUMINUM FLUX
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Universal Oxygen Co.
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Burdett Oxygen Co.
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Federal Brass Works.
Hauck Mfg. Co.
Smith's Inventions, Inc.
The Alexander Milburn Co
Torchweld Equipment Co.

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The Welding Engineer
P. F. Willis

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Bermo Supply Co.
Davis-Bournonville Co.
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Torchweld Equipment Co.
Universal Oxygen Co.

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Bermo Supply Co.
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Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

CARBIDE (Calcium)
Canada Carbide Sales Co.
Union Carbide Sales Co.

CARBON (Blocks, Paste, Etc.)
National Carbon Co.

CARBON REMOVING TORCHES
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Bermo Supply Co.
Davis-Bournonville Co.
Federal Brass Works.
Henderson-Willis Welding & Cutting Co
International Oxygen Co.
The Imperial Brass Mfg. Co.
Messer Mfg. Co.
The Alexander Milburn Co.
Oxweld Acetylene Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Mach. Co.
Torchweld Equipment Co.
Universal Oxygen Co

CAST IRON FILLER RODS AND FLUX
Air Reduction Sales Co.
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Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
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Cortland Welding Compound Co.
Davis-Bournonville Co.
Hauck Mfg. Co.
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The Imperial Brass Mfg. Co
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Superior Oxy-Acetylene Machine Co
Torchweld Equipment Co.
United States Welding Co.
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Electrolytic Oxy-Hydrogen Laboratories, Inc.
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FILLER RODS (Swedish Iron)
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Superior Oxy-Acetylene Machine Co.
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Universal Oxygen Co.

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Bermo Supply Co
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Central Steel & Wire Co.
Davis-Bournonville Co.
International Oxygen Co.
The Imperial Brass Mfg. Co
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co
Steel Sales Corp.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

FILLER RODS (Vanadium Steel)
Air Reduction Sales Co.
Apex Steel Corporation
Bermo Supply Co.
Burdett Oxygen Co.
Bierman-Everett Fdy. Co.
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Davis-Bournonville Co.
Hauck Mfg. Co.
International Oxygen Co.
The Imperial Brass Mfg. Co
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Steel Sales Corp.
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Superior Oxy-Acetylene Machine Co
United States Welding Co.
Universal Oxygen Co.

FIREPROOF PLASTIC
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Universal Oxygen Co.

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Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

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GENERATORS (Oxygen or Hydrogen)
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Universal Oxygen Co.

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K-G Welding & Cutting Co.
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Superior Oxy-Acetylene Machine Co
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

HOISTING MACHINERY

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Superior Oxy-Acetylene Machine Co
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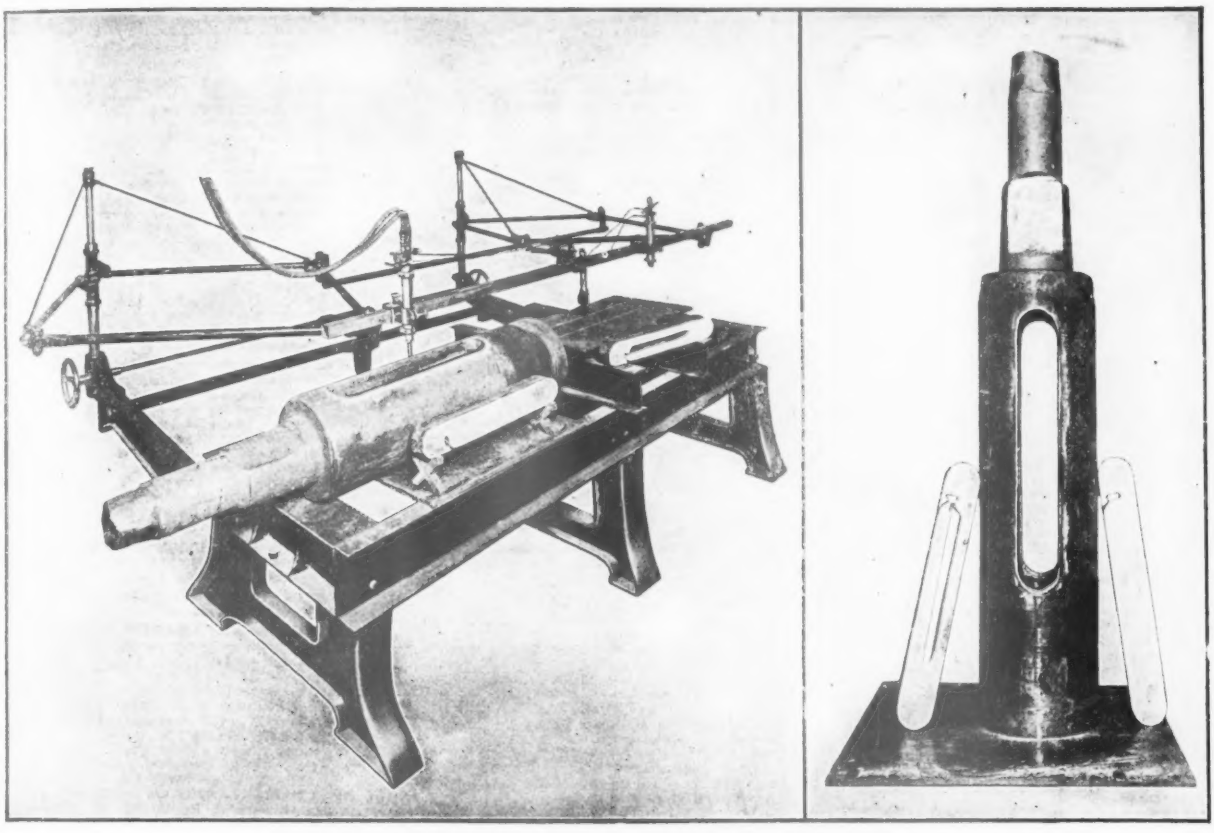
Air Reduction Sales Co.
Burdett Oxygen Co.
Electrolytic Oxy-Hydrogen Laboratories, Inc.
International Oxygen Co.
Universal Oxygen Co.

Fishing In Oklahoma



On the Right—A Fishing Tool!
On the Left—A Davis-Bournonville Oxygraph

The "fishing tool" wouldn't be recognized as such by any follower of Isaac Walton—it is used in fishing out broken tubes in oil wells.

The "Oxygraph" is one of the Davis-Bournonville exclusive developments for mechanical cutting of steel with the oxy-acetylene or oxy-hydrogen flame. The Oxygraph has a bed frame 30 in. by 9 ft. The frame above the bed moves back to permit service by shop crane for heavy plate or sections. The movement of the cutting torch is directed by means of a motor-driven tracing wheel, guided along a pattern or template. This cast steel fishing tool weighed 900 lbs. It is hollow, and two long openings in each side of the cylinder are required. The wall is 2½ in. thick. The cutting was done on the Oxygraph in our Chicago shops for the Oklahoma Iron Works, manufacturers of these tools. At the left, the tool is shown in position for cutting on the Oxygraph,—at the right, the two openings through the tool are shown and the two sections cut out. No further finishing of the cut is necessary. Time of cutting, 21 minutes, for 10 lineal feet of cutting through 2½-in. steel casting; cost for oxygen and acetylene 28 cents per lineal foot of cut.

The Oxygraph has great value for cutting steel plate and billets or cast sections; the cut is made in any direction, following straight lines, curves or angles, quickly and at low cost. Davis-Bournonville apparatus offers the widest range of equipment for obtaining the full value of oxy-acetylene and oxy-hydrogen processes, including gas production and distribution, welding and cutting apparatus. Consult any of our offices.

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NEEDLE VALVES
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K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.

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Torchweld Equipment Co.
United States Welding Co.
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United States Welding Co.
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Universal Regulator Co.

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Henderson-Willis Welding & Cutting Co.
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The Imperial Brass Mfg. Co.
Messer Mfg. Co.
K-G Welding & Cutting Co.
The Alexander Milburn Co.
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Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
The Thermalene Co.
Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.

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Air Reduction Sales Co.
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Bermo Supply Co.
Burdett Oxygen Co.
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Federal Brass Works.
Messer Mfg. Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
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Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
The Thermalene Co.
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Universal Oxygen Co.

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The Bastian-Blessing Co.

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Burdett Oxygen Co.
Davis-Bournonville Co.
Federal Brass Works.
Messer & Co.
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International Oxygen Co.
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The Imperial Brass Mfg. Co.
Torchweld Equipment Co.
Oxweld Acetylene Co.
Prest-O-Lite Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

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Burdett Oxygen Co.
Messer Mfg. Co.
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International Oxygen Co.
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The Alexander Milburn Co.
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Smith's Inventions, Inc.
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United States Welding Co.
Universal Oxygen Co.

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Torchweld Equipment Co.
United States Welding Co.
Universal Oxygen Co.
The Bastian-Blessing Co.
Air Reduction Sales Co.
Burdett Oxygen Co.

VALVES (For Oxygen Cylinders)
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Universal Oxygen Co.

WELDING APPARATUS
See also "Torches."

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General Electric Co.
Gibb Instrument Co.
Westinghouse Elec. Mfg. Co.
Wilson Welder Metals Corp.

WELDERS' GLOVES
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International Oxygen Co.
F. H. Wheeler Mfg. Co.

WELDERS' GOGGLES
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Burdett Oxygen Co.
Chicago Eye Shield Co.
J. E. Histed
Ideal Face Shield Co.
International Oxygen Co.
Torchweld Equipment Co.

WELDING (Oxygen for)
The Linde Air Products Co.
Air Reduction Sales Co.
Burdett Oxygen Co.
International Oxygen Co.
Universal Oxygen Co.

WELDING RODS AND WIRE
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Air Reduction Sales Co.
Apex Steel Corporation
Bierman-Everett Fdy. Co.
Burdett Oxygen Co.
Central Steel & Wire Co.
Federal Tool & Alloy Steel Corp.
International Oxygen Co.
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Steel Sales Corporation
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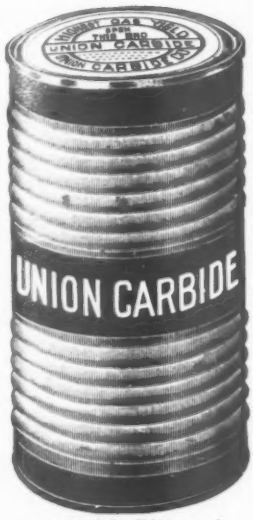
Southern Welding Mach. Co.

T
The Thermalene Co.
R. J. Tobin
Torchweld Equipment Co. Front Cover

U
Union Carbide Sales Co.
United States Welding Co.
Universal Oxygen Co.
Universal Regulator Co.
U. S. Gauge Co.

W
Weldit Acetylene Co.
Westinghouse Elec. Mfg. Co.
Willis, P. F.
Wilson Welder & Metal Co., Inc.
F. H. Wheeler Mfg. Co.



Packed in Blue and Gray Drums

Union Carbide Sales Company

New York City, 42nd St. Building | **Chicago, Ill., Peoples Gas Building** | **San Francisco, Cal., Kohl Building**

SOLE DISTRIBUTORS OF

UNION CARBIDE

"World's Best Quality—Highest Gas Yield"

For Oxy-Acetylene Welding Plants

Contractors' Flare Lights, Torches and Private and Municipal Lighting Plants

"Union Carbide" is packed in 100-lb. blue and gray drums marked conspicuously, "UNION CARBIDE."

The following sizes are carried in stock in 100-lb. drums:

$3\frac{1}{2}$ x 2 in. —a large size.

$1\frac{1}{4}$ x $\frac{3}{8}$ in. —an intermediate size.

2 x $\frac{1}{2}$ in. —a medium size.

$\frac{1}{4}$ x 1/12 in. —finely crushed size.

Union Carbide in the Generator sizes above listed will be shipped direct to consumers from a Union **Carbide Sales Co.** warehouse at any one of the following points where large stocks are kept on hand:

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Birmingham—1916 Morris Ave.
Mobile—16 S. Commerce St.
Montgomery—114 N. Perry St.
ARIZONA
Phoenix—42 S. Central Ave.
ARKANSAS
Fort Smith—109-123 So. Ninth St.
CALIFORNIA
Fresno—932 H St.
Los Angeles—639 Gibbon St.
Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
San Francisco—Kohl Building.
COLORADO
Denver—Nineteenth and Wazee Sts.
CONNECTICUT
Hartford—412 Trumbull St.
DISTRICT OF COLUMBIA
Washington—Maryland Ave. and 9th St., S. W.
FLORIDA
Jacksonville—515 W. Bay St.
Tampa—107 Madison St.
GEORGIA
Atlanta—Cor. Haynes and Rhodes Sts., P. O. Box 1594.
Savannah—Ogeechee Canal, South of Bay St., P. O. Box 78.
ILLINOIS
Chicago—Peoples Gas Bldg., Michigan Blvd.
Decatur—133-147 W. Williams St.
East St. Louis—600 Walnut Ave.
Peoria—100-110 Edmund St.
Monmouth—124 E. Archer Ave.
Marion—315 S. Granite St., Box 747.
Quincy—222 S. Eighth St.
Streator—702 East Elm St.
INDIANA
Evansville—1601 Illinois St.
Fort Wayne—2216 Broadway.
Indianapolis—110-112 S. Alabama St.
Terre Haute—921 Wabash Ave.
IOWA
Davenport—118 Harrison St.
Des Moines—3rd and Elm Sts.
Dubuque—8th and Washington Sts.
Ottumwa—207-9-11 S. Washington St.
Sioux City—925 Fourth St., P. O. Box 98.
KANSAS
Pittsburg—109 W. Third St.
Salina—154 So. 5th St.
Wichita—721 Beacon Building.
KENTUCKY
Louisville—126 E. Main St.
Middlesboro—1701 Cumberland Ave.
LOUISIANA
New Orleans—819-21 Julia St.
MAINE
Portland—11 Exchange St.
MARYLAND
Baltimore—19 E. Lombard St.
Cumberland—1 N. Liberty St.
Salisbury—Opp. Fulton Station.
MASSACHUSETTS
Boston—(See Cambridge "A.")
Cambridge—241 Albany St.
Springfield—Napier St.
MICHIGAN
Detroit—Grand River and Lorain Ave.
Grand Rapids—500 Shawmut Ave., N. W.
Hancock—First National Bank Bldg.
Iron Mountain—215 E. A St.
Jackson—172 South Water St.
Muskegon—43 No. Terrace St.
Saginaw—1830 No. Michigan Ave.
Sault Ste. Marie.
MINNESOTA
Minneapolis—334 N. First St.
Virginia—413 Chestnut St.
MISSISSIPPI
Vicksburg—1312 Washington St.
MISSOURI
Kansas City—1316-1318 W. Eighth St.
St. Joseph—920 S. Sixth St., Sta. "A."
St. Louis—(See East St. Louis, Ill.)
NEBRASKA
Omaha—1007-9-11 Jones St., Union Sta. P. O.
NEW JERSEY
Camden—West and Clinton Sts.
Jersey City—554-56 Henderson St.
NEW YORK
Albany—Montgomery and Colonie Sts.
Binghamton—21 Jarvis St.
Geneva—Exchange St. and Railroad Pl.
Hurleyville—W. J. Prince & Son.
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Kingston—O'Neil St., near Broadway.
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Poughkeepsie—Smith St. and N. Y., N. H. & H. R. R. Tracks.
Utica—135 Hotel St.
Watertown—438 Court St.
Whitehall—22 Main St.
NORTH CAROLINA
Charlotte—Post Office Box 777.
Raleigh—117 Fayetteville St.
Wilmington—Room 16 Masonic Temple, 13 N. Front St.
NORTH DAKOTA
Fargo—17 Broadway.
OHIO
Cincinnati—67 Plum St.
Cleveland—601 The Citizens' Building.
Columbus—330 Dublin Ave.
Dayton—812-828 E. First St.
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Steubenville—The John C. Fitzsimmons Lumber Co., 324-343 Uorth Seventh St.
Toledo—414 S. Erie St.
Zanesville—Main and Second Sts.
OKLAHOMA
Oklahoma City—27-29 E. Grand Ave.
Tulsa—1—11 No. Boulder St.
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Portland—Fifteenth and Hoyt Sts.
PENNSYLVANIA
Beaver—359 Beaver St.
Du Bois—Webber Ave. and Franklin St.
Erie—1426 Chestnut St.
E. Greensburg—Clark and George St.
Harrisburg—627 Walnut St.
Johnstown—Messenger St. & B. & O. R. R.
Pittsburgh—1202 Chamber of Commerce Building.
Pottsville—Railroad and Sanderson Sts.
Scranton—Penn Ave. and Vine St.
Shamokin—5th and Walnut Sts.
Williamsport—Canal and Court Sts.
SOUTH CAROLINA
Charleston—153 Church St.
TENNESSEE
Chattanooga—627 Volunteer State Ins. Bldg.
Knoxville—426 West Depot Ave.
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Nashville—105-107-109 Broadway.
TEXAS
Dallas—802-810 Cadiz St.
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Houston—Baker and Cedar Sts., Box 745.
San Antonio—Cbr. Leal and N. Salado Sts.
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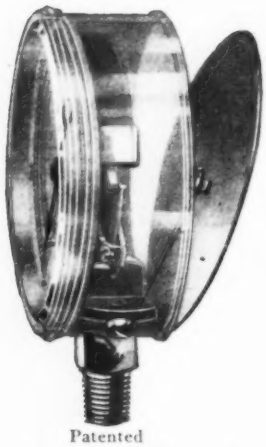
UTAH
Salt Lake City—118 W. Second South St.
VIRGINIA
Lynchburg—1324 Commerce St.
Norfolk—513 Front St.
Richmond—18th and Cary Sts.
WEST VIRGINIA
Bluefield—195 Roanoke St.
Charleston—Broad St. and K. & M. R. R.
Fairmont—"A" Street.
Huntington—820 3rd Avenue.
WASHINGTON
Seattle—1103 First Ave.
Spokane—646 Peyton Building.
WISCONSIN
La Crosse—Front and King Streets.
Madison—513-19 Williamson Street.
Milwaukee—120-134 Jefferson St.

We recommend our customers to **select** from the list, the **city** from which the quickest delivery and lowest freight rate can be obtained, **and address their orders to "Union Carbide Sales Company"** at the distributing point selected **accompanied by remittance.** Please address request for information or special correspondence to either the New York or Chicago office.



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What Produced the Most Satisfactory Oxy-Acetylene Gauge?

One thought!

We have tried to serve our customers so well, and to supply their needs so satisfactorily, that nothing could justify their leaving us.

Result—the safest, most accurate and economical Oxy-Acetylene Gauge on the market.

United States Gauge Co.
67 Wall Street, New York
Distributing Agents Throughout the World
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WHEELER PROTECTION PAYS

Be on the safe side. Use Wheeler Protective Wearing Apparel and avoid loss of life and money. Send for particulars of our complete line of Asbestos, Fireproofed Duck and Leather Gloves, Mittens, Leggings, Spats, Coats, Pants, Helmets, etc. Write today.

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Fluxes That Flux

Aluminum Welding

is difficult, in many cases impossible, without the aid of the correct flux.

Deebee Aluminum Powder
for Cast and Plate Aluminum and

Napolitan Flux
for Sheet Aluminum

Have been developed and are manufactured in the Davis-Bournonville laboratories.

These fluxes immediately dissolve the aluminum oxide, permitting the metal to unite, and contain no chemicals that will injure the weld.

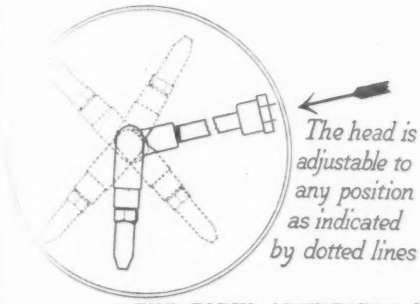
Write for sample

WELDING AND CUTTING DAVIS APPARATUS DAVIS-BOURNONVILLE Co. N.Y.

Davis-Bournonville Company
General Office and Factory
Jersey City, N. J.

Tobin's Adjustable Head

Operates from any position. No loss of time or gases. The nozzle may be moved into any desired position without twisting or rotating the handle or hose.



The head is adjustable to any position as indicated by dotted lines

THE TOBIN ADJUSTABLE HEAD

may be attached to any standard welding torch. It is now in successful operation on the Pacific Coast, particularly on Burdett Torches. A constant and uniform flow of gas is assured—no change in your regular torch—simply more flexibility in manipulation. This torch was used on cabinet work on U. S. Destroyers in ship yards, the most inaccessible work being handled with ease. The Tobin Head is equally efficient on heavy work.

When writing for information send sketch of your torch, showing size of threads.

Write for prices and particulars.

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Universal Oxygen Company

SHEBOYGAN WISCONSIN

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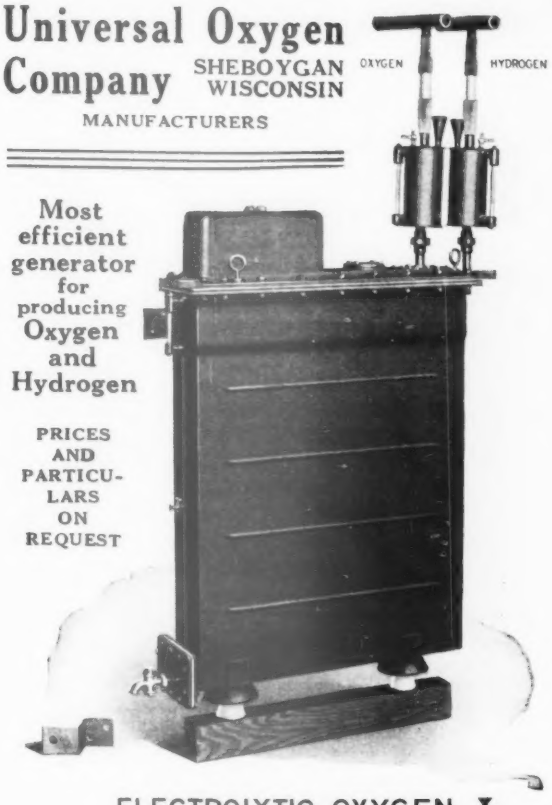

Most efficient generator for producing Oxygen and Hydrogen

PRICES AND PARTICULARS ON REQUEST

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Anti-Borax Welding Fluxes

It Pays to Use Only the Best

Better and stronger welds are more easily and more quickly made with Anti-Borax Welding Fluxes. That's real economy.

For Cast Iron, Brass, Bronze, Malleable Iron, Steel, Cast and Sheet Aluminum.

Anti-Borax Fluxes are scientific preparations which weld at lower heat, leave no scale, cleanse the molten metal, assist fusion and improve the quality of your work.

Anti-Borax Fluxes are the best that money can buy, yet they cost no more—usually less than inferior brands.

Guaranteed to give perfect satisfaction or your money refunded.

WRITE FOR PRICE LIST AND SAMPLE.

Anti-Borax Compound Company
FT. WAYNE, INDIANA

No. 8-G for Natural Gas, $6.50

Preheating Blowpipes

The two most essential points in welding are:

FIRST: The use of a proper sized oxy-acetylene flame.

SECOND: The saving of gas by preheating your work for the oxy-acetylene flame.

The first is under your control in the use of the oxy-acetylene apparatus you have selected.

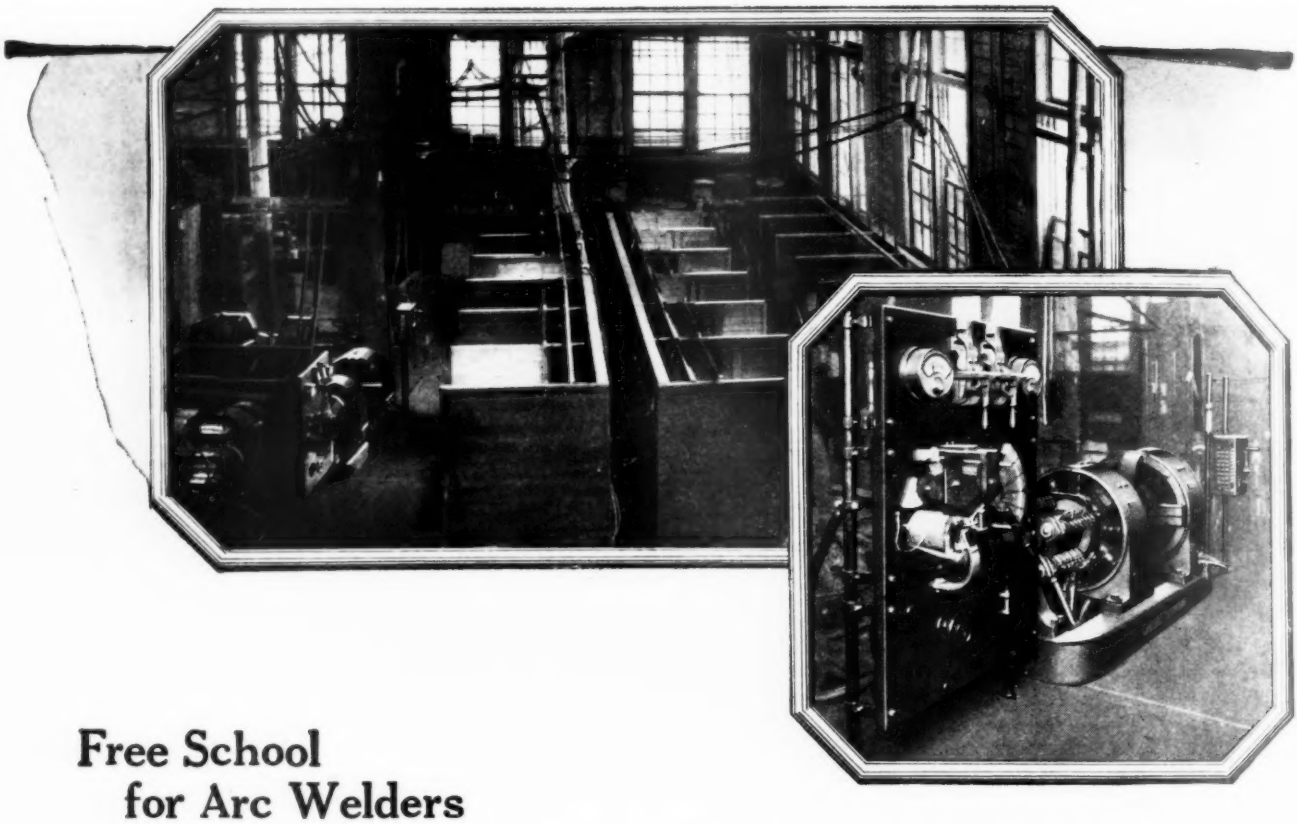
The second, we can aid you in by supplying the proper blowpipe for preheating purposes.

We manufacture blowpipes for use with Coal Gas, Natural Gas, Gasoline Gas and Acetylene Gas, with Air Blast.

Our catalog "B. X." free for the asking, contains full description and prices. WANT ONE?

Buffalo Dental Manufacturing Co.
Buffalo, N. Y., U. S. A.

Specialized industrial training eliminates mistakes that are costly in time and material.



Free School for Arc Welders

THE above illustration shows two views taken in the General Electric Company arc welding school at Schenectady, where courses are given in the following work:

Course 1: Repairs to steel castings.

Course 2: Repairs to iron castings.

Course 3: Repairs to steel plates and tanks.

Course 4: Recovery of broken taps and drills from castings.

Course 5: Welding of high-speed steel to low-carbon steel.

Course 6: Welding and cutting by carbon arc.

In from six to eight weeks men who have had no arc welding experience become efficient welders at the General Electric Company school in Schenectady.

Each student's record is kept and will be mailed on request to employer sending him to school.

This training is necessary as, unless operator holds a steady arc of uniform length, "cold welds" will be formed which will readily break open when subjected to a strain.

Dozens of prominent firms and departments of the U. S. Government availed themselves of the opportunity to have their men receive this exceptional training.

Instruction is free of charge to employees of those purchasing G-E arc welding equipment.

General Electric Company

General Office Schenectady, N.Y.

Master Welders

Use

"Federal" Regulators

For Oxygen, Acetylene and Hydrogen Gases

Here's the Reason Why:

"FEDERAL" Regulators are made of the very best materials by expert mechanics for expert welders who know the value of and appreciate absolutely dependable Regulators.

They are passed by the National Board of Underwriters and their safety features make accidents to operators practically impossible.

FEDERAL BRASS WORKS

31st St. and Kedzie Ave. CHICAGO

Swift's Pure Oxygen

"A Reputation Imposes an Obligation"

Swift Oxygen must pass the most rigid tests —must never vary from its high quality standard.

Swift Oxygen is produced in the largest electrolytic plant in the U. S. A.—in ample quantities to render unequalled service to our customers.

The use of Swift Oxygen in your plant will aid you in raising the standard of the work of your operators.

The Name is Your Guarantee

Swift & Company,

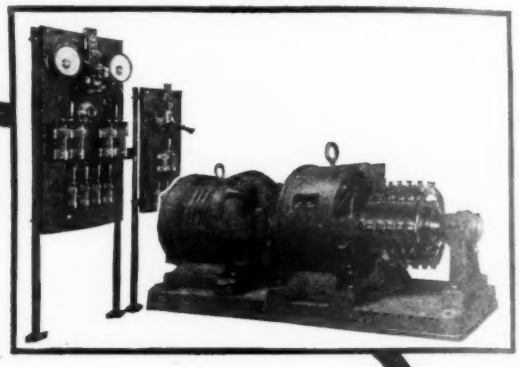
Oxygen Department

Union Stock Yards Chicago, Ill.

Your Welding Equipment Must Supply

"PEP" AND STABILITY

To The Welding Arc



The three prime requisites of Electric Arc Welding Equipments are—

1. Sufficient potential capacity to sustain the arc when lengthened, for you have to overcome irregularities in the material being welded, which causes variations in the resistance of the circuit.
2. In starting the arc your current should not shoot up too high, but should be above the normal welding current in order to give the necessary heat at the start.
3. **Constant heat** at the arc. This requires variable voltage at the arc to maintain constant current, **as the heat of the arc depends on the current flowing.** The reason that variable voltage is required to maintain constant current is due to variation in the resistance of the arc path or circuit due to the following (a) foreign matter such as scale, rust, etc., in the path of the arc, (b) variations in the length of the arc caused by the molten metal traveling from the electrode to the weld, (c) unsteadiness of the operator's hand and (d) unevenness of the surface over which the welding arc is directed.

Westinghouse Electric Arc Welding Equipments meet these requirements.
Built in sizes from 150 ampere to 1,000 ampere capacity.

1. Single operator equipment—Stationary type.
2. Single operator equipment—Portable type.
3. Multiple operator equipment.

Built for all commercial circuits; either alternating or direct current.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

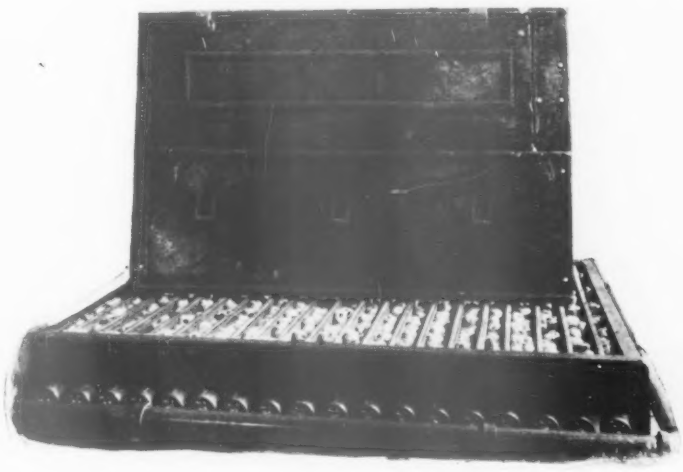
Westinghouse

W
WESTINGHOUSE ELECTRIC

Two Pictures That Tell a Vivid Story

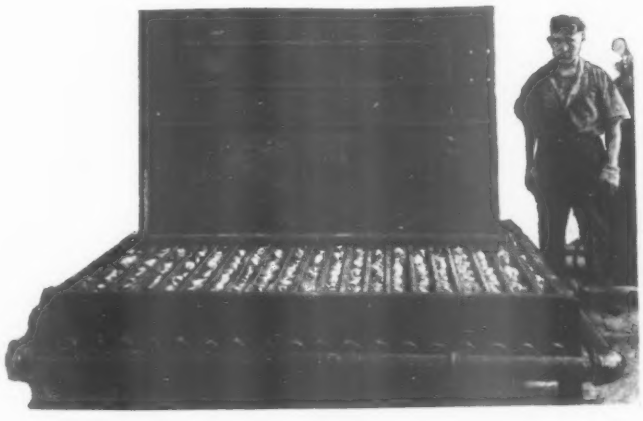
The huge casting shown in these pictures is a cast iron section of a purifying box used in the manufacture of illuminating gas. It measures 49″x75″, and varies from 2 to 5 inches in thickness. Its cost is in the neighborhood of $200. This casting was heavily cracked in several places, requiring in total about seven feet of welding with one and a quarter inch metal.

That was the job.



Because of its great flat surface, several welders declared it could not be done by usual preheating methods. It was too susceptible to warping and to fracture by chill. One man reckoned it would take all day to preheat it, and would require the consumption of 20 bags of charcoal.

This casting was placed upon the Wiederwax floor model Preheater shown in the pictures. Alternate burners were turned half on and lighted, and in one and a half hours the casting was a cherry red all over. With a water cooled torch, it required three and a half hours to weld it, or a total of five hours for both preheating and welding. In all that time the Preheater consumed 2,500 cubic feet of gas at $1.15 per thousand cubic feet, or $2.88 worth of gas. 150 feet of oxygen, and 150 feet of acetylene were used in welding. After being finished it was covered with pieces of sheet iron, and left all night to cool. The heat retained by the heat absorbing element in the top of the Preheater dissipated itself gradually, so that by morning the perfectly cooled piece was ready to move. Not a crack, or a flaw, or a warp could be found.



Several welders who witnessed the demonstration declared that it was perhaps the most difficult test any preheating medium could have been subjected to by reason of the great size of the casting and the unusual area of flat surface. The upper picture shows the casting before being welded. Note the size and length of the cracks. In the lower picture the same casting is shown after the welding had been completed and the piece cooled. The welder was paid a hundred dollars for the job. His costs could not have been more than $40 at the most. These are the sort of profits the Wiederwax Preheater makes for your shop.

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The Geist Manufacturing Company

2001 Atlantic Ave. Dept. X **Atlantic City, N. J.**

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MORE GAS PER POUND

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Richmond, 1319 E. Main St.

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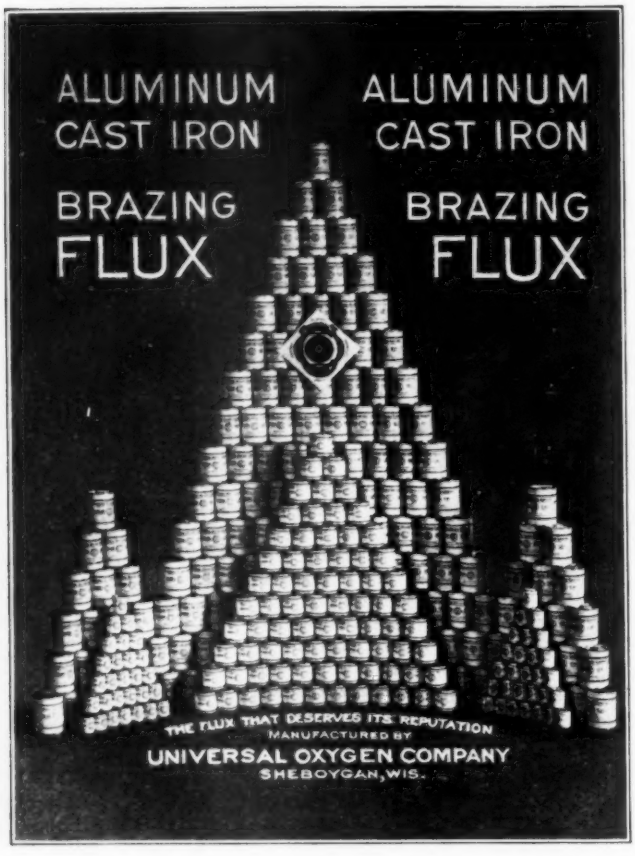
"Weld-a-cast" is a scientific combination of chemicals, that causes the metal to melt rapidly, shortening the operation, thus economizing in time, gas and oxygen.

"Weld-a-cast" adheres readily to the hot welding rod which picks up just enough and none is wasted; it does not blow away but melts at once; it eliminates blow holes and leaves the metal soft.

Write For Free Samples

CORTLAND WELDING COMPOUND CO.
CORTLAND, N. Y.



P E X

APEX WALLOON WELDING WIRE

The Highest Quality Welding Wire Made

SWEDISH MATERIAL *for* OXY ACETYLENE *and* ARC WELDING

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50 CHURCH STREET, N.Y.

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FURNISH A DEPENDABLE SUPPLY OF PURE OXYGEN

An installation of Levin Cells places at your disposal a constant supply of pure oxygen upon which you can always rely. As long as you have water and electric power, you can always make your own oxygen. You will not be delayed in your welding operations because your supply of gas in charged cylinders is exhausted or has been delayed in reaching you.

In addition the installation will deliver without additional charge a continuous supply of Hydrogen for cutting purposes.

300 Levin Cells at General Electric Co., Erie, Pa.

And both the Oxygen and Hydrogen are furnished at a cost less than half that of the Oxygen in charged cylinders alone.

Steel Plant, Foundry, Shipyard and boiler shop cannot afford to be without an Electrolabs installation.

Write for complete details

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I. H. LEVIN, Technical Director

Laboratories and Works: Dayton, Ohio

Electrolabs
ELECTROLYTIC GAS APPARATUS

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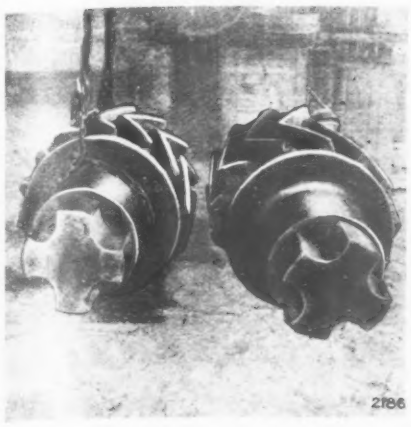
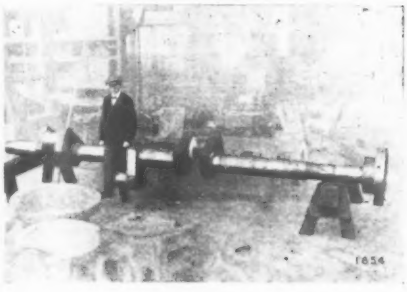


Roll and Pinion Repairs

Shear Repairs



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Now is the Time to Weed Out Your Scrap "Garden"

Now that the abnormal overtime work of business, due to the pressure of war conditions, has ceased, this is the opportune time for you to search your scrap piles for damaged heavy steel equipment which now is only worth its salvage value to your company and which can be repaired as good as new by THERMIT WELDING at a great saving over the high cost of new equipment.

We shall be pleased to send one of our experts to your plant to help you with this survey and decide what Thermit Welding material and appliances would be required to repair the damaged equipment.

We have had long experience in repairing:

Large Crankshafts
Roll and Pinion Necks
Roll and Pinion Pods
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Factories located at Chrome, N. J., Wyandotte, Mich., East Chicago, Ind., Jersey City, N. J.

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AND ASSOCIATED COMPANIES

ELECTROLYTIC OXYGEN and HYDROGEN - 99 1/2 % Pure

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Detroit, Michigan
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Cincinnati, Ohio
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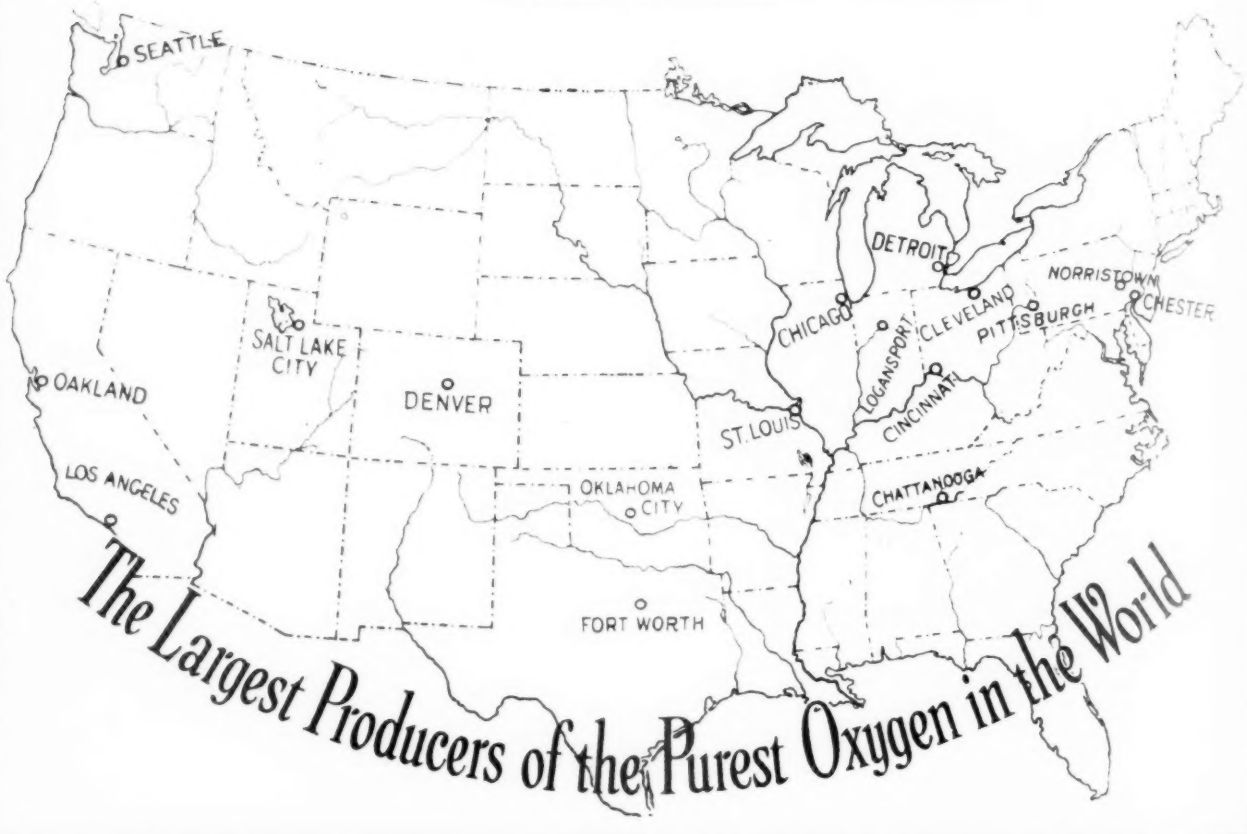

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WELDING JIGS *and* METHODS *of* OVERCOMING DISTORTION*

By C. S. Milne, Managing Director of C. S. Milne & Co., Ltd.; Member of the British Acetylene and Welding Association

In my opinion, the questions of jigging and overcoming distortion are, so far as new work is concerned, so intimately connected with what I call "design suitable for welding" that I shall endeavor in my examples to point out what I consider are, and what are not, "designs suitable for welding."

In repair work the question of design does not arise; that has already been settled by the maker of the article. All the welder is concerned with is the problem of overcoming distortion, or further fracture, sometimes a very difficult problem. In repair work every job must be taken separately, on its merits, and here the ability of the individual welder to foresee his troubles and take the necessary precautions, plays a great part whereas I contend that, to obtain cheap and efficient production, in new work, the draftsman is the man who should do most of the thinking, and he should produce a design which, if properly jigged, can be welded by any operator capable of handling the blowpipe.

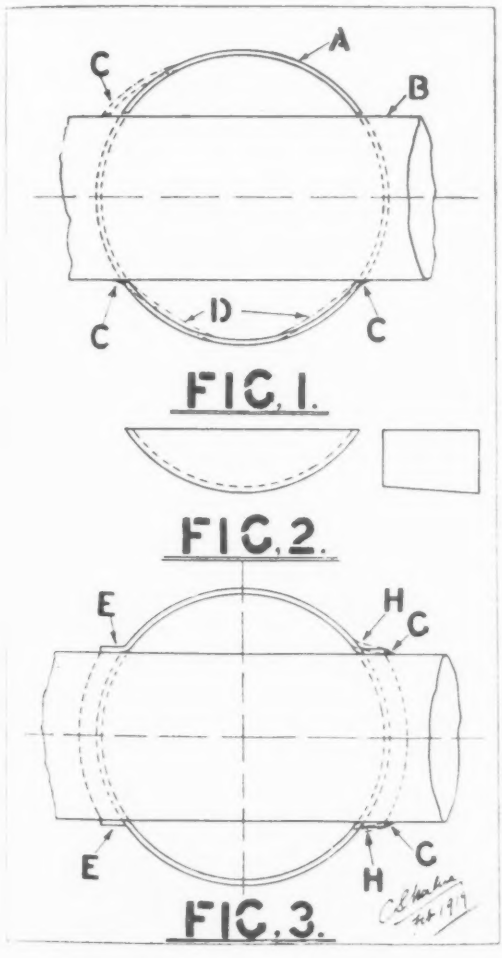


FIG. 1.

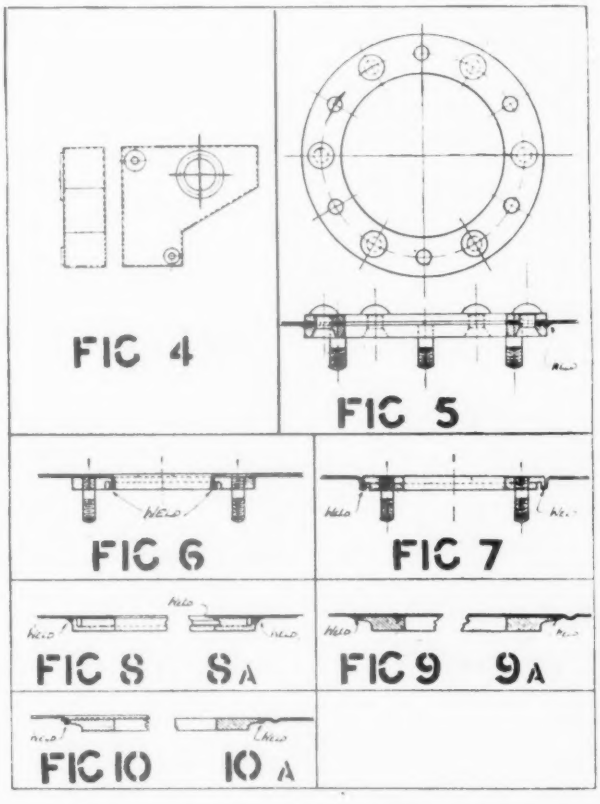
FIG. 2.

FIG. 3.

Prior to the war most government departments looked upon oxy-acetylene welding as still in a somewhat experimental stage, only to be used on work of minor importance. A number of engineers also looked upon it with considerable scepticism. The exigencies of war have wrought a miraculous conversion, and some of these reformed sceptics have recently let their zeal, for having everything welded, outrun their knowledge of "design suitable for welding."

In this matter of design, a great deal of education is still required by designer and draftsman before welding can attain its full scope of usefulness. The vast majority of draftsmen have not served their apprenticeship as engineers in shops where oxy-aceylene welding was used, so that they do not know the most rudimentary principles of welding, and, therefore, when setting out to design an article which is to be welded, they produce a design which makes the article unnecessarily liable to distortion, difficult to weld, expensive to produce, and infinitely less efficient as regards strength than it might easily be.

It is not my desire to try to absolve all welders from blame in the matter of failures in welded work, but in the manufacture of welded articles, in any ordinary commercial way, it is unfair to the welder to design an article which will require 100 per cent efficiency at the weld, in order that it may have a reasonable chance of successfully withstanding the stresses which will be put upon it in prolonged use.



It is also unfair to produce a design which, in the very nature of things, must distort badly in the process of manufacture, and then slang the welder for turning out an article which looks like nothing but a piece of scrap iron.

There is nothing so disheartening to the welder, or so likely to make him careless in the production of his work, as the feeling that, however much care he may exercise, he cannot possibly produce a really sound or nice looking job, because the design is such that distortion must take place.

Much can be done by jigs, but a jig which holds the article

*Extracts from a paper read at a general meeting of the British Acetylene and Welding Association, April 10th, 1919.

to shape at the expense of the strength of the weld is only meeting the trouble half-way, and producing an article which, even if sound when leaving the shop, is likely to give way after a short life, owing to internal strains.

The function of the jig should be to hold the parts in the proper position for welding and at the same time to allow expansion and contraction to take place. It should not hold the parts in position by sheer force.

In repetition work I am convinced that money spent on jigs is money well spent, and the design of simple and efficient jigs, in order to produce accurate work, often affords foods for much thought, and is worthy of more attention than is usually given to the subject.

It is interesting to note, and augurs well for the future of the welding industry, that this association is not the only place where the merits of welding are being discussed.

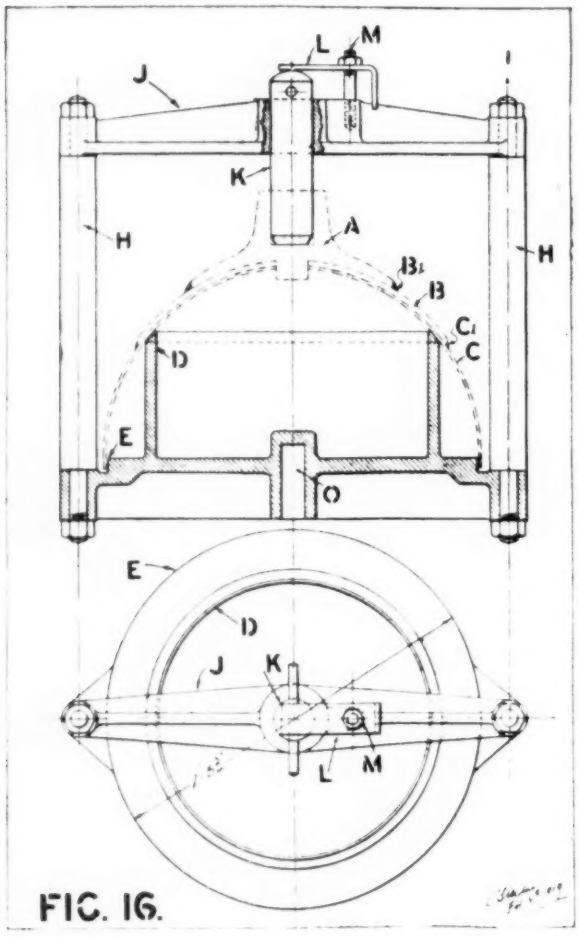


FIG. 16.

Since our last meeting, and since I wrote the foregoing remarks, no less than four papers dealing with welding have been read before the Institute of Mechanical Engineers, three dealing exclusively with the oxy-acetylene system and the fourth with electric welding, the last by Mr. Thomas Heaton, of the Uxbridge Barrel Company, who probably has as wide a knowledge of the application of all modern methods of welding as any man in the country.

Two quotations are, I think, very opposite, one showing that, even when discussing electric welding, the large sphere of usefulness of the oxy-acetylene process, in which we are specially interested, has to be recognized. He says, "The author holds no brief for any given system of welding, and in confining this paper to electric welding he does not intend to imply that gas welding produces inferior welds. Indeed, he is of opinion that each known system of welding has its proper sphere, and that probably any given method may be best in its respectively most suitable application. The author uses oxy-acetylene welding, and has done so for many years before the war with satisfactory results."

Again, when discussing one of the arc welding systems, he says, "The work, however, must be designed to suit the process and the process regulated to suit the work, in order to be successful. Distortion due to the heat, or the effect of contrac-

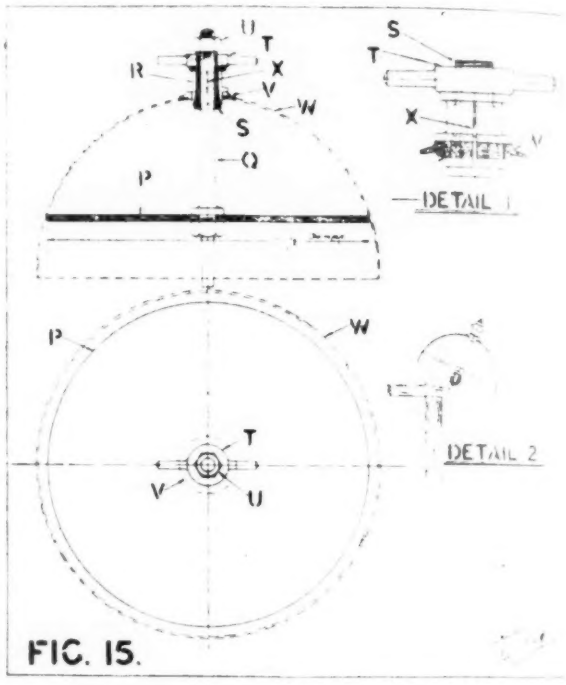


FIG. 15.

tion, must be allowed for, especially on flat surfaces, and anyone requiring welded joints would do well to consult the welding expert before definitely deciding on the details of his design."

This entirely confirms my own views, but I have frequently hear the statement made that with arc welding no allowance need be made for contraction and distortion, so I am very glad to see this statement made by one who has employed electric welding for about twenty-five years.

The spheres of usefulness for oxy-acetylene welding are consider larger than those of other methods, and can be increased and perfected, if careful attention is paid to correct design, in order to overcome distortion.

In dealing with light sheet or plate welding, it is not possible to overcome distortion by heating the whole job during welding. This cure would probably be worse than the disease. It is therefore necessary to look to other methods.

In the early days of oxy-acetylene welding, owing to the distortion difficulty, even makers of oxy-acetylene welding apparatus, who were out to boom this process, continued to produce their generators with rivetted seams. I well remember one of my own difficulties with the first generator which I produced welded throughout, and which will serve to illustrate my point as regards "design to overcome distortion."

Fig. 1 is a tube passing through a larger tube. The holes in plate "A" were cut about ⅛ inch larger than the tube "B" which was to pass through in order that it might be easy to get it into place. The weld was made as shown at "C," with the almost inevitable result that on cooling, after welding, the contraction put a buckle in plate "A," as indicated by the dotted line "D." This was partly caused by the fact that "A" when heated, expanded outwards, and, instead of being welded in its true position at "C," was really welded on as shown at dotted line "C."

Now had I been sending this design out broadcast, ordering thousands off, I should have been in a fair way to creating fresh fever amongst those dealing with the job.

The same example will serve to illustrate my point regarding

the unfairness of expecting 100 per cent efficiency in the weld.

The makers would, in all probability, have said, we must make a jig, something like Fig. 2, to wedge in and stop this buckling, with the result that the weld would be put in severe tension while cooling. The probable outcome would be that a number of the articles under test would show porosity in the weld, or cracks in, or just alongside, the weld. The design is therefore undoubtedly defective and must be modified if good work is to be produced.

After various trials the design shown in Fig. 3 was adopted. Plate "A" was flanged, as shown at "E," and the weld made at "G." Dotted line "H" shows how the contraction after welding is taken up. This overcomes the difficulty of buckling and so entirely eliminates the strain that no buckling takes place, and jigs are not required. It is therefore, I consider, a sound design.

Several better methods, which might have been substituted, are shown in Figs. 6, 7, 8, 9 and 10. I am sure one of these have been used, and would have been quite suitable, for the purposes for which the tank was required.

It may be argued that by rivetting the plate between two rings, as in Fig. 5, greater strength is obtained than by the welding only, but I contend that the weld on the outside of the heavy flange would put such internal strains on the plate that if fracture were to occur it would be at this point, so that ring and rivets would all come away together.

By flanging the plalte and grooving the ring, as shown in Fig. 6, the edges to be welded are of equal thickness and a good weld can be easily made. No distortion of the thin plate takes place and no stresses are set up by welding. The studs can be taken right through the ring without fear of leakage. It has, however, the disadvantage that if a faulty weld be made it is

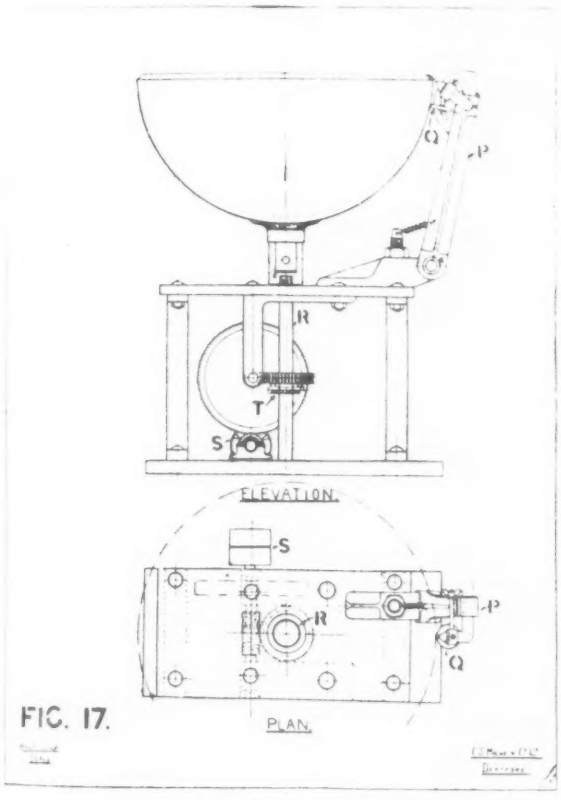


FIG. 17.

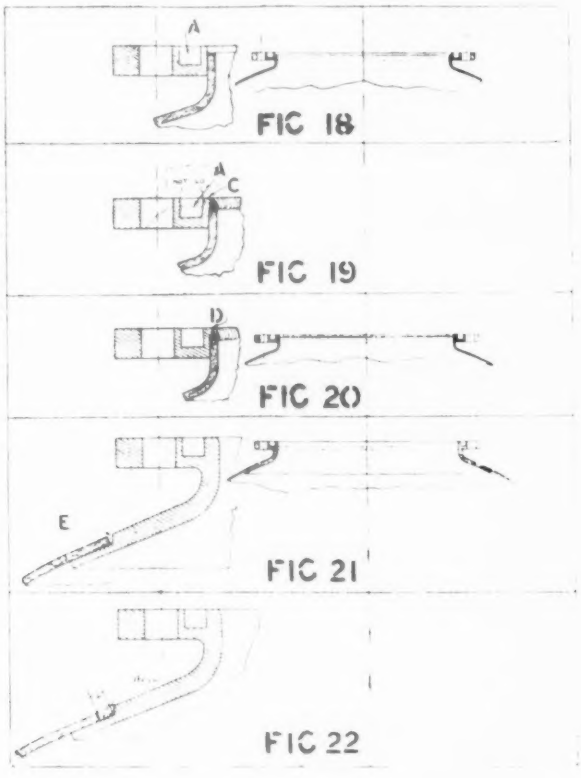


Fig. 4 is an instance of a type of design one frequently meets. A tank of ⅛ inch plate with flat sides having several pads for pipe connections, hand holes, etc. In this case it was specified that these pads were to be rivetted and welded on. The weld was indicated as in Fig. 5. Now my objections to this are:

1. That I consider it bad practice to weld and rivet the same joint. If rivetting will make a sound joint, why weld? On the other hand, if it is necessary to weld to obtain a tight joint, why put in rivets, which will in all probability leak sooner or later?

2. I defy any welder to make such a weld as that shown in Fig. 5, because the penetration under the flange is shown about ½ inch deep, and the width of the "V" at the top, ⅜ inch.

3. The design of the flange is quite suitable for welding to a flat surface and must be greatly modified if successful work is to be obtained.

The weld could, in my opinion, only be made at all by employing a second blowpipe of large size to heat the thick flange while one man did the welding; otherwise the ⅛-inch plate would be burnt before the thick flange became hot. In any case the result would be an enormous strain on the weld, and the bottom side of the tank would be distorted, so as to look like a ploughed field. This would not be due to any fault of the welder.

almost impossible under test to locate the position of the leak. Fig. 7 overcomes this last objection and is stronger still, owing to the greater area of the weld, but there is danger of leakage at the studs if these are taken right through the ring.

By grooving the outside edge of the flange, as shown in Fig. 8, a weld of similar appearance to Fig. 5 is obtained while the stresses in the flat plate are to some extent reduced. By also grooving the inner edges, as shown in Fig. 8a, a seal is obtained if studs are taken through the ring.

By thinning the edge of the flange as shown in Fig. 9, the welding is simplified, but will leave considerable stresses in the weld and surrounding plate. If, however, a corrugation can be stamped in the plate round the flange, as shown in Fig. 9a, it relieves the stresses and makes quite a sound method, and it can be combined with an inside weld, as in Fig. 8a, if desired.

For some purposes the methods shown in Figs. 10 and 10a are preferable. The radius (Fig. 10) or corrugation (Fig. 10a) relieve the cooling stresses, but careful jigging is required to keep the edge of the thin plate from buckling in or out during the actual welding.

The type of flange shown in Fig. 9 is very suitable for welding to spherical work or dished ends of vessels, as in this case the spherical end gives to the contraction by flattening. Fig. 11 is a photograph of a section of such a weld, being one taken at random from some thousands done recently. The distortion

Fig. 12 is a photograph of a woman welder engaged in welding on one of these flanges. The pate seen, connecting the two flanges, is a simple jig to hold the flanges down, and to keep the studs in correct position in relation to each other, and to base of the hemisphere.

I recently had to weld on to hemispheres a large number of screwed bosses, a section of which is shown in Fig. 13. The method of welding is again as shown in Fig. 9. The difficulty experienced in this case was that the thread, which had to pass fine limit gauges, distorted and required retapping. The heat slightly scaled the surface of the top threads and the life of the taps cutting this scaly surface was short. Fig. 14 shows the job in process of execution.

When, later on, a similar job had to be done, steps were taken to prevent distortion and avoid tapping. Fig. 15 shows the jig used. In this job, I may mention, it was also essential that the thread should be kept concentric with the the axis of the hemisphere. This makes this jig more complicated than would be required for merely preventing distortion of the thread.

The screwed boss "V" had to be welded to hemisphere "W." "P" is a circular plate with a pillar "Q" at the center. "R" is a screwed bush bored taper inside and split, as shown at "X,"

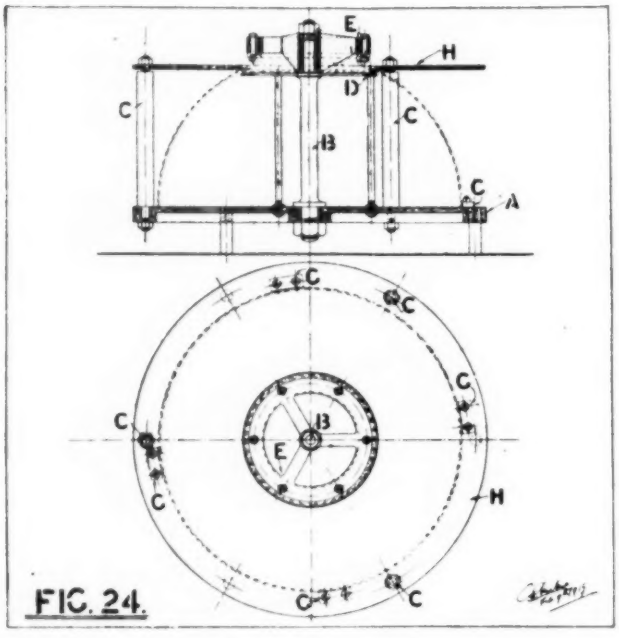


FIG. 24.

so that it can be expanded. "S" is a tapered plug to fit "R" and bored a sliding fit to pin "Q." "T" is a fly-nut for drawing up the plug "S" in bush "R." "U" is a nut for holding the whole on to pin "Q." The hemisphere "W" is dropped over the pin "Q" and finds its own bearing on plate "P." The boss "V" is screwed on to the expanding bush "R" and this is then expanded by inserting plug "S" and tightening up nut "T," as shown in Detail 1. Several sets of these parts (Detail 1) are provided to each set of parts "P" and "Q."

The whole of Detail 1 is dropped on pin "Q" which ensures the thread being true with the axis of the sphere, nut "U" is tightened down lightly to keep the whole in position during welding.

After welding, by merely removing nut "U," the whole expanding device is removed bodily with the boss and hemisphere, and is left to cool while another part is put on pin "Q" for welding.

The lower extension of "Q" fits in a socket on the welding bench, as shown in Detail 2, which holds the work at a convenient angle for the welder, and makes the whole easy to swing round as welding proceeds. This is very useful, as, in the case referred to, the jig and job weighed something well over one cwt.

It was found that, if the expanding bush is left in position till the work is cold, the thread is prevented from distorting and will pass fine limit gauges after welding.

Another jig used for the manufacture of the same article is shown in Fig. 16. In this case a boss "A" and stiffening cup "B" had to be welded to a hemisphere "C" at "C1" and "C1." Here again the hole in the boss had to be truly concentric with the axis of the sphere.

The hemisphere is supported on the casting "D," while the bottom edge is registered by ring "E." From the base of the casting spring two pillars "H.H." supporting a cross bar "J," in which a hole is bored concentric with rings "D" and "E," through which passes pin "K" into the hole in boss "A," the pin being a nice sliding fit to the hole and about two-thousandths less in diameter than the low limit of hole in boss. As the limit of the hole in "A" was only four-thousandths of an inch, the pin is always practically a fit to the hole in "A," and ensures that this must be concentric with the axis of the sphere. The pressure on pin "K," to hold the whole together during welding, is given by plate "L" and stud "M." This makes not only a very quick method of fixing and releasing, as about one turn of the nut will slacken plate "L," so that it can be turned out of the way while pin "K" is removed, but "L," being made of spring steel, while giving the required pressure, allows for expanding during welding.

This jig, like the last one described, is fixed on a pin at "O" at a convenient angle so as to turn easily during welding.

You will notice that the edge of the boss "A" is thinned to about the same thickness as cup "B," and the edge of cup "B" is thinned to about the thickness of the hemisphere, which greatly assists sound welding.

The hemispheres shown in the two preceding Figs. 13 and 15 had afterwards to be welded together and to be an exact overall length after welding.

As the welding already referred to caused slight shortening and distortion, a cutting device was resorted to for cutting off the hemispheres to the correct length, after the parts had been welded on. The hemispheres were left up to that time with rough edges as they came from the press. A diagram of this device or machine is shown in Fig. 17.

The cutting blowpipe is held in a swing arm "P" at an angle so as to make a bevel cut which will give the necessary chamfer for welding. "Q" is a wheel which keeps the nozzle of the pipe always at the correct distance from the work. The work is attached to spindle "R." "S" is a fast and loose pulley, which is coupled to the line shaft in the shop with a belt. Spur and worm reduction gears bring the speed at which the work is revolved to the speed at which the blowpipe will do its work.

The blowpipe, which is an ordinary hand cutter, is fit and the work heated. As soon as the cutting jet of oxygen is opened the belt is thrown over on to the fixed pulley, which starts the work revolving. The result is the well known clean cut obtained with machine cutting devices.

In order to avoid the waste of time involved by slowly revolving the work a whole revolution, if a backfire occurred or the cut failed at one part for any other reasor, a ratchet device was fixed at "T" enabling the work to be quickly pulled round by hand.

Two further forms of joints in spherical work are shown in Figs. 18 and 21, both are for the same purpose, but the first gave rise to so many failures that the second was resorted to.

The test applied was 60 lbs. per square inch internal and 300 lbs. external, pressure. This puts a strain of 3 tons and 15 tons respectively on the weld, besides which the article weighing some 7 cwt., was lifted by the cover on this flange. The snatch of a carelessly handled crane might put quite unknown stresses on it, but the design shown in Fig. 18 should stand this if properly welded.

Some causes of defects were:

1. The groove "A" had to be correct to the hundredth part of an inch in width, depth, and diameter, and the contraction after welding, distorted the groove, as shown in Fig. 19 with

the rest that the Not Go gauge would enter and the fitter was obliged to hammer the inner edge back cold, putting severe strain on the weld.

2. The diameter frequently distorted oval, so that the diameter gauge would enter one way on the diameter and not on the other. This was corrected by cramping when cold and put further strain on the weld.

3. Perhaps the greatest of all the causes of trouble was that we were supposed to keep ⅛-inch face at "C," Fig. 19, consequently the welder, in fear of melting away the edge of the ring too much, failed to make a weld at all.

Except where such fine limits are required in the groove, the design is, I think, fairly sound and many of the failures were doubtless due to thoroughly defective welding. Anyhow, I was responsible for the welding of some 1,500 of these joints and had no complaint of defects after delivery, but I did slightly modify the design, as shown on Fig. 20.

By thickening the edge, as shown at "D," Fig. 20, it can be freely melted without losing the face, and a better weld is made.

In the method of welding employed in Fig. 21, you will see that the hemisphere is shown lapped over the mouthpiece, which is a somewhat elaborate forging. The mouthpiece is machined at "E" to register into the hole in the hemisphere, with only such play. In a case of this kind, where one part is thick and the other thin, this makes a very poor weld.

A concession was made allowing the hole in the hemisphere to be increased, and the joint was made as shown in Fig. 22, but this did not end the troubles. When the hemisphere was heated with the blowpipe, as might be expected, owing to its shape, it expanded outwards, and this not a matter of ½ inch or so which would have been of no importance, but a matter of about ⅛ inch. Even if clamped and tacked in six places, it lifted some ¼ inch between tacks as welding proceeded.

Fig. 23 is a photograph of a section cut from one hemisphere which was clamped down in six places by boiler screws, and shows the lift. On cooling, not only was the hemisphere distorted, but the bolt flange was buckled about ⅛ inch from the flat. A heavy cast iron ring was bolted on with six bolts and a further attempt was made, but when the ring was removed the distortion, though reduced, was still about ⅛ inch.

Fig. 23a shows a photograph of two of the articles with the ring welded on after the difficulties had been overcome.

The jig shown in Fig. 24 shows how the difficulties were overcome. It consists of a base plate "A" on legs, with a spindle "B" at the center, and three columns "C" at the outside. The supporting ring "D," on legs, is merely used to hold up the mouthpieces until the heavy cast iron ring is bolted on to it. The heavy ring "E" drops on spindle "B" which holds it true with the base plate "A," and the correct height therefrom. The hemisphere is then dropped over and kept concentric with the mouth by four blocks "G," on the base plate. Over the columns "C" is dropped a ½-inch steel plate "H," with a chamfered hole at the center, about ¾ inch larger in diameter than the hole in the hemisphere. This is tightly clamped down by the nuts on columns and prevents the hemisphere from rising off the mouthpiece.

The weld is completed while still clamped in the jig, when, by removing plate "H" and nut on spindle "B," the hemisphere and mouthpiece can be removed with ring "E" still bolted on. The ring "E" is left on till cold. This almost entirely prevents distortion of the bolt flange of the mouthpiece from the flat. It was found that from nineteen to twenty-three thousands of an inch shrinkage took place in the diameter of the pitch circle of bolt holes and groove, and the diameter of the groove and holes had to be machined accordingly.

The plate "H" has the advantage of acting as a baffle plate, to keep the flame off any large surface of the hemisphere, and also absorbs a large amount of heat from the hemisphere plate, thereby preventing the burning of the thin edge of the hemisphere, before the thicker mouthpiece is brought to welding temperature.

The execution of this weld had the effect of making the hemisphere shorten about ⅛ inch and distort slightly on the bottom edge. I had these machined at the bottom edge before putting on the mouthpiece, but, if I had to do this job again, I would resort to a cutting device like that already shown for a smaller hemisphere, as it is quicker and cheaper than machining and just as effective.

While I hold no brief for this design of joint, and do not consider it a good design, it certainly is an instance where suitable jigging made a most successful job of what at first appeared to be almost impossible. The reason being that, undoubtedly, the jig reduced the area of plate heated by the pipe, and, while using a certain amount of force to hold the work together, did not use it in such a way as to put great stress on the weld when the job was finished.

I have done nearly 1,000 of these hemispheres and hardly ever got even a pinhole, under test, and I have on occasion, given the welds a severe hammering with a 7-pound hammer before testing, without any ill effects.

Fig. 25 shows the jig in operation.

Fig. 26 shows a simple jig to overcome the ordinary welder's aversion to putting a thing on the right way round. This holds two lifting eyes in correct relation to each other.

One frequently meets with such work as that shown in the photograph, Fig. 27, namely light sheet metal covers,

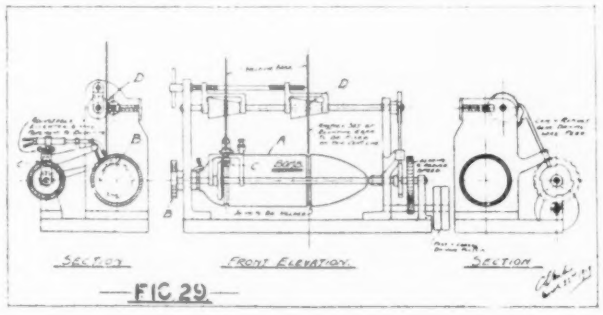


FIG 29

⅛ inch thick, or less, welded to heavy flanges. This is always a difficult and somewhat unsatisfactory job to weld, but it is hard to see how to improve the design for welding without greatly increasing the cost of preparing the work. The difficulties are:

1. That the thin plate is overheated before the flange is brought to welding heat.
2. That welding along the inner edge causes shrinkage of this edge and consequent curvature of the flange.

A fairly satisfactory method of overcoming these difficulties is to heat along the outer edge of the flange with a larger blow pipe, this makes it possible to get a good weld without burning the thin plate, and to some extent counteracts the distortion, but even then some curvature takes place and I have found it satisfactory to set straight flanges to a slight outward curve, before welding, and to make curved flanges of a somewhat larger radius. The amount of allowances to be made has to be found out by trial.

Everyone who has had to weld long longitudinal seams, in sheet metal or plate, knows the difficulty of making the right allowances for the drawing together of the seam as welding proceeds, and also the difficulty of the edges of the plate buckling up or down, so that a perfect butt is not obtained.

Fig. 28 shows a very useful jig for overcoming this. It is a curved mandrel with a narrow hollow running down

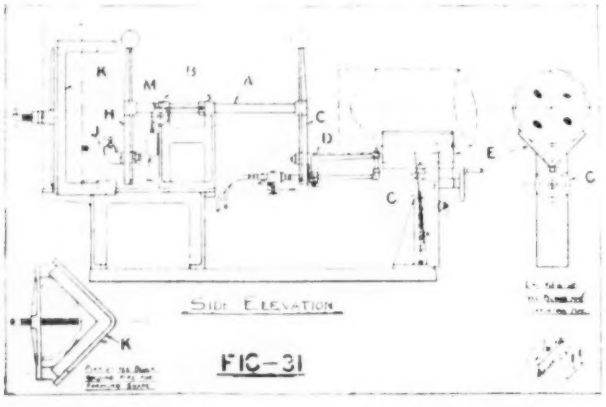
it. It is fitted with two clamps which can be swung aside to put the work in place, and afterwards tightened down by bolts at each end.

The joint comes over the hollow in the mandrel so that little heat is lost during welding, and the clamps are sufficiently near the joint to keep it properly butted together.

The joint is left open the desired amount, at the far end, and pulls together under the clamps. If it comes together too quickly the clamps can be tightened to restrain it or, if the reverse, the clamps can be slightly loosened to allow the plate to come together more quickly. When the clamps are opened, as in the photograph, it makes a very useful mandrel for shaping up the work. I have these in various radii suitable for diameters from 5 inches up to 5 feet and lengths up to 6 feet.

At one time during the war, the shortage of welders forced me to consider making an automatic welding machine, a matter which has been much neglected in this country. I was at the time considering the manufacture of 9½-inch trench mortar bombs, which were made of ⅜-inch plate. The bomb is shown at "A," Fig. 29. It struck me that the two circumferential seams might possibly be welded, both at the same time, by machine.

I made an experimental machine for the purpose, and several trial welds were made showing considerable promise, but owing to the order for the bombs not maturing, it was never perfected. I am hoping shortly to continue my investigations.



FIG—31

A slight explanation of the lines on which I worked may, however, be of interest.

The machine was operated by a belt drive off the line shafting of the shop and, through various gearing, turned the work, moved the blowpipe and fed in the welding wire. The work was held in centers, and a ratchet "B" moved the work around, under the blowpipe, about ⅜ inch at regular intervals.

The blowpipe, through bevel gearing "C," was given a circular motion, making four revolutions to every forward movement of the work.

The wire was fed down into the weld, by friction, between a V-shaped wheel "D" and cone-shaped roller, the object of the latter being to provide a variation of the rate of feed, by driving off the larger or smaller diameter on the cone. The cone was turned intermittently by a ratchet arrangement "E" which was adjustable.

The blowpipe was of the ordinary hand variety, but my experience led me to believe that a water cooled nozzle would be beneficial. The movement of the pipe was not altogether satisfactory, but with some modification I hope to be able to produce a serviceable machine.

Most of you are probably familiar with the type of cutting machine shown in Fig. 30, for cutting holes or circles in plates, and holes in tube, from 1½-inch diameter to 12-inch diameter. When cutting holes in a pipe, the blowpipe can be raised and lowered by means of the lever, at the same time as it is turned, so that the nozzle can be kept at all times, the correct distance from the work.

I claim no novelty for this, but I do for that shown in Fig. 31. This is for cutting the ends of branch pipes to the correct form for fitting on to the main pipe.

It is laborious business to set out on a drawing board the profile of branch pipes, and, when a template has been made and the line marked on the pipe, it is still difficult to cut accurately to the mark. This machine, however, does the work automatically for any size branch pipe, up to 12-inch diameter, to fit any size main pipe, up to 12-inch diameter.

The method of operating is as follows:

"A" is a shaft which can turn and slide in bearings "B."

The slide "C," keyed to this shaft, has a carrier "D" for the cutting blowpipe. This carrier can be set at any desired distance from the center of shaft "A."

The Vee block "E" carries the pipe which is to be cut, and can be raised and lowered, by means of screw and gear "G," so that, whatever the size of the pipe to be cut, it can be set concentric with the shaft "A."

The other end of the shaft "A" has got keyed to it a slide "H," fitted with a carrier for a former wheel "J," which can also be set at any desired distance from the center of shaft "A."

"K" is a Vee block in which a short length of pipe can be clamped vertically.

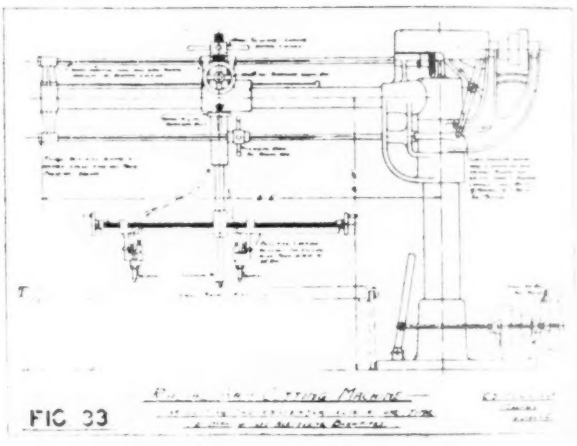


FIG 33

If, for example, a 6-inch branch pipe has to be fitted to a 9-inch main, a piece of 9-inch pipe must be clamped in Vee block "K," and a piece of 6-inch pipe put on Vee block "E," which latter is then set concentric with shaft "A" and the cutting blowpipe set so that the nozzle is about ¼ inch from the outside of the pipe.

The former wheel "J" is set by the scale on slide "H" to 3-inch radius (that is, half the diameter of the pipe to be cut).

Now as shaft "A" can slide, as well as turn, and as it is attached to weight "L," by a wire running over a pulley "M," the former wheel "J" will be kept on to the face of Vee block "K," so that when the shaft is revolved, the blowpipe takes not only the circumferential movement, but also the longitudinal movement imparted by the wheel running on the curve of the pipe.

According to the size of the pipe, and radius on which the wheel "J" runs, the shape of the cut made by the blowpipe will vary.

Fig. 32 shows a cutting blowpipe guide which is particularly useful for bevelling the edges of plates to prepare them for welding. For this purpose one wheel is flanged to run over the edge of the plate. It is also useful for many other purposes.

Fig. 33 is practically a radial drilling machine with the cutting blowpipe as a drill. By the combination of the vertical

cones for drive, and the special drive in the head, infinite variety of speed, between one revolution in 1½ minutes and one revolution in 24 minutes, can be obtained, and the speed can be varied, by means of the lever, while the machine is running.

It was designed for cutting flanges from plate 2 inches thick and upwards. It is fitted with two cutting heads to cut the inside and outside of the flange at one time. Provided the difference in radii is not too great, the slight loss of oxygen, from one cut not being made at its greatest speed, is more than compensated for by the time saved.

To revert to the subject of welding for a few moments, I should like to show one or two pictures of repair work in the process of execution.

In the case of repair work, and particularly of cast iron repairs, I am a great believer in charcoal fires for heating in order to reduce cooling stresses.

My objections to the muffle furnace are:

1. That, unless one specializes in one particular class of work, the jobs vary so much in size that frequently one cannot get them into the muffle.
2. That frequently it is neither useful nor advisable to heat the whole casting.
3. To my mind the most serious objection is, that, as the work has to be drawn out of the muffle to be welded, the body of the casting is cooling just at the moment when the part being welded is being made hotter.

Now with the charcoal fire the opposite takes place, because the job can be welded while in the fire, and the draft set up by the blowpipe flame tends to fan the surrounding charcoal to a greater heat, thus evening up the heat on the surrounding casting.

If the casting is a large one, and only part of it wants to be heated (Fig. 34), the fire can be built around the part to be heated and, if desired, this fire can be moved with the casting, so that the work on all parts can be done in the most desirable position. Figs. 34, 35 and 36 show this.

The fracture being welded was the equivalent of a break, through "AA," in both sides of the frame, Fig. 34. It was lined up and clamped together and a sheet metal fire box was welded together around it. After the part which could be got at had been welded, it was turned on its side, and the work continued as in Fig. 35, the box full of red hot charcoal going with it. It was then raised on its end, as shown in Fig. 36, and completed.

In this way no chilling takes place during welding, and the weld can be done in the most favorable position. I personally have very little faith in vertical welding on cast iron, though in steel perfect work can be done, consequently, I like to be able to turn the casting so as to work always on the flat.

Another example of partial heating is shown in Fig. 37. This wheel had to transmit 240 horsepower and, since the repair was made has been working for several years.

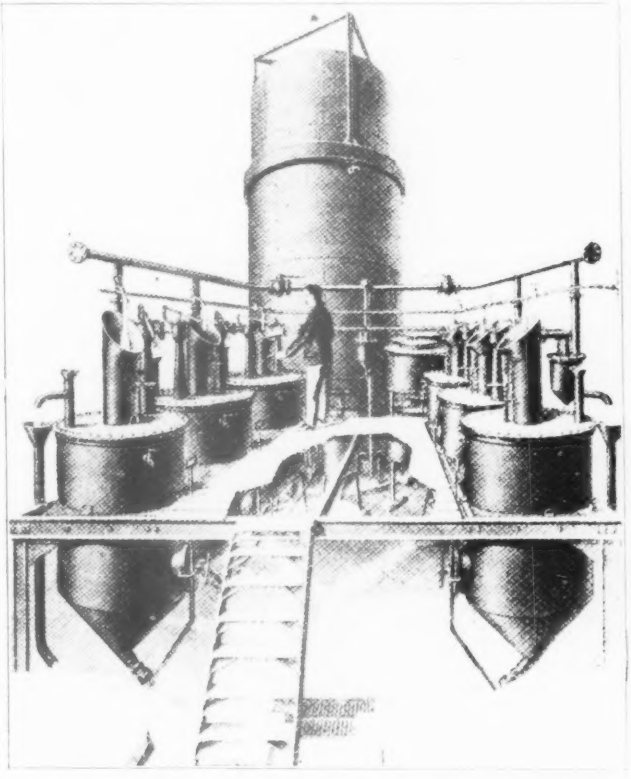
ACETYLENE GENERATING PLANT FOR LARGE WELDING SHOPS.*

The accompanying illustration shows a large type of generating plant which has been installed in several large oxy-acetylene welding workshops in France. The first plant of this type was constructed for a factory manufacturing war material at Creil, and this plant used about five tons of calcium carbide a day. The plant has since been improved and installed in numerous large workshops. The general characteristics of the plant were retained but improvements in the devices for charging and automatic cleaning were added.

The plant shown in the photograph consists of seven generators, gas collector, moisture separator, two condensers, a gasometer capable of storing 350 cubic feet of gas and four large purifiers with suitable by-passes for working in pairs. The gas collector piping and the main pipe line are 5 inches in diameter. The passages through the valve have an area equivalent to 4 inches diameter; the pressure of the gas, which is regulated by the gasholder, is represented by 10 inches of water. It is easy to see that the number of generators can be increased or reduced according to the consumption of acetylene required. With six generators and two attendants it is easy to produce 4,500 to 5,000 cubic feet of acetylene per hour which corresponds to the introduction of 1,100 to 1,200 pounds of carbide, or say 11,000 pounds per working day of 10 hours. The same type of plant, known as the Girel, is made with one or two generators only and equipped with a gasholder of from 35 to 170 cubic feet capacity, this size having proved satisfactory for many workshops.

Each generator contains from 100 to 130 gallons of water and this quantity is sufficient to decompose an ordinary drum of carbide without removing the residue which can, however, be evacuated in the form of milk of lime.

However, developments have shown that automatic evacuation of the residue is preferable and this is brought about by simply



opening the water cock and allowing water to flow into the channel where the carbide is introduced. The rise in water level produces an increase of pressure in the interior of the generator and causes the lime residue, even when it is dense, to rise in a tube the lower part of which is in the lower cone of the generator and the exit above the cover of the generator.

The regulation of the cock controlling the fresh water is made according to the size of the plant, the aim being to evacuate the residue at a temperature of about 50° C., because at this temperature the quantity of acetylene dissolved in the water is negligible. The introduction of clean cold water in the same passage as that into which the carbide is introduced has the advantage of allowing the carbide to fall continually into water at a low temperature; further the attack is much slower so that there is practically no loss of gas during the few seconds when carbide is introduced. There is the further advantage that the water washes the internal surface of the channel so that no traces of chalk are present as this would allow carbide dust

*From the Acetylene and Welding Journal (England).

and small grains to adhere to the sides of the channel and lead to overheating effects.

It should be noted that automatic cleaning avoids introduction of air into the generator, a very distinct advantage where security of the installation and the good working of the blowpipes is in question. From time to time a thorough cleaning of the plant is essential and for this purpose a sluice valve is opened at the base of the generator when solid sludge can be removed and thorough washing can be carried out. A manhole is fitted in the side of the generator for the inspection of the interior including the grating on which decomposition of the carbide takes place.

The carbide is dispersed on a grid by means of a cone fixed to the charging tube. A movable sleeve surrounds the lower part of the charging tube and this can be moved vertically on to, or away from, the dispersing cone by means of a handle operated from the charging platform. This sleeve can be adjusted so that whatever size of carbide is used there is a free passage into the generator and after the introduction of a charge the sleeve can be lowered so as to rest on the cone and prevent any gas bubbles escaping by means of the charging tube. To prevent eddying and too great a disturbance of the water two circular vertical partitions are placed at different levels in the generator.

These various devices enable one to charge the generator in the same manner as coal is charged into a furnace and at a rate of 150 to 175 pounds per hour per generator. With continuous automatic cleaning, it is possible to at least double the rate of gas production, without any loss of gas or introduction of air, the reaction taking place under the best temperature conditions and in consequence with great regularity.

The automatic evacuation of the residue works smoothly and should the end of the tube become obstructed as a result of the residue becoming too pasty or even solid, a very rare event, it can be released by means of an iron rod or by agitating the residue by means of a crank or lever.

The gas yield of a generator of this design is much higher than the usual type of carbide to water generator and the importance of this fact is readily seen when one considers that with such plants it is a question of using thousands of tons of carbide.

The details and accessories which cannot be dealt with here will bear careful study. It is of interest to note in conclusion that the generator and gasometer have been constructed by oxy-acetylene welding from 1/8 inch sheet steel while the various details such as angle irons, piping, etc., are also welded, and are excellent specimens of work done with the blowpipe.

D. R.

WELDING LOCOMOTIVE FIRE BOXES.

Realizing that the practice of welding locomotive fireboxes instead of riveting, is receiving increased attention in locomotive shops, the Air Reduction Sales Company of New York, has prepared and published a booklet describing the Airco process of oxyacetylene welding as applied to this character of work.

The new booklet is designed to help the operator by showing him the proper methods to follow when welding a firebox. It describes the operations necessary for full and semi-welded side sheets, cracks in side sheets, full welded door and flue sheets, patches on fireboxes and flue sheets, patches on mudring, welding of door collars and door holes, building up worn edges of fireboxes, etc. Full page drawings illustrate the different operations.

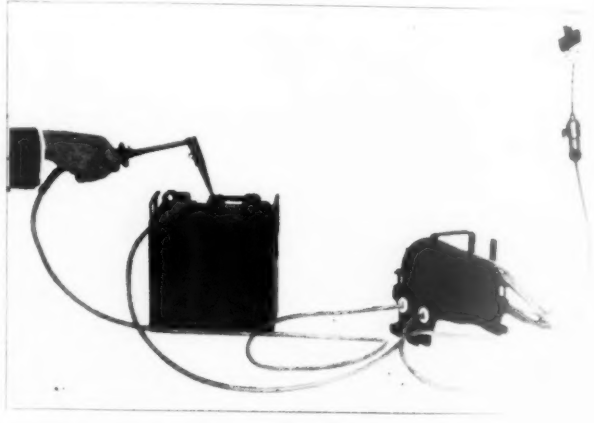
A LEAD BURNING TRANSFORMER.

By L. E. Klingman, Transformer Engineering Department, General Electric Company.

There has been a great demand for some means of burning posts and straps on storage batteries, other than those which are at present employed, namely, oxy-acetylene and oxy-hydrogen. An electric lead burner has been developed by the General Electric Co. for this purpose.

Several schemes were tried with the application of electricity. One was the use of an arrangement similar to an arc welding outfit using a storage battery to supply the energy. The conductor from one terminal of the battery was fastened to the post or strap to be burned. The other was attached to piece of material having a high thermal and relatively high electrical resistance, such as carbon. Upon bringing the carbon in contact with the lead, energy is used up in high contact resistance between the carbon and lead. The carbon point quickly becomes heated up to incandescence and furnishes the heat to puddle the lead. It will be noted that this was not an arc welding process and that no arc was drawn during the burning, but the nose of the carbon was kept immersed, perhaps 1/16 inch in the lead.

When the battery to be burned had a sufficient number of cells, three or four of its cells adjacent to the joint to be burned were used to supply the energy. The conductor or jumper having a carbon electrode was fastened to a cell terminal three or four cells away from the work, and the circuit was completed through the carbon and the post or strap to be burned on the battery. Either of these methods, however, have the disadvantage that the battery used to supply the energy must be up to full charge in order to furnish sufficient power, and that after the burning is completed, the battery is completely discharged. For this reason the above methods are not practical or economical.



Lead burning Transformer burning posts on storage battery.

Another scheme of incandescent welding or burning was developed using a transformer. The primary took power from an electric light circuit—the secondary or low voltage side furnished power through a duplex cable lead to a piece of nichrome resistance wire serving as a heating unit for melting or puddling the lead. This was an improvement over previous ideas. However, due to the fact that the secondary leads were large and cumbersome, and the heating unit crude, satisfactory results could not be obtained.

After careful study and several experiments, a method was developed using a combination of both of the above schemes. The transformer takes energy from the lighting circuit and delivers energy at about six volts at the secondary terminals. Secondary leads, originally cotton covered, were brought out separately, one conductor terminating in the carbon holder and the other in a spring clip to connect to the work. In this case the carbon point is heated by contact resistance as in the first method above. With this arrangement the lead is readily puddled to compare very well with gas burners.

This outfit seemed promising, but after first trials it was found necessary to make several improvements. As the leads are continually exposed to the corroding action of the acid they were replaced by a rubber covered cable which was not

Another improvement was the design of a better carbon holder and handle so that the carbon would be some distance from the wood handle, as it was found that the temperature attained was sufficient to burn it or to heat it up so that it could not be handled by the operator.

The new carbon holder is made in the same style as the torch used in gas burning, which the operators are accustomed to manipulate. It is composed of three principal parts, namely, a coil spring, handle and a carbon holder. The phosphor bronze spring screws into the handle and serves to keep the conductor from wearing at the entrance to the handle, and also assists the operator in controlling the electrode. The handle is made of wood and is turned to fit the handle nicely. The brass carbon holder is made in an "L" shape, the stem being longer and somewhat smaller in diameter than the holder. The cable passes through the spring and then through the handle into the binding post formed in the enlarged end of the stem, where it is secured by a set screw. The set screw also serves the purpose of securing the carbon holder into the handle.

The carbon holder is designed to admit 5/8 inch carbon, which is clamped by a thumb screw. Carbons can be changed very readily.

The phosphor bronze clip used for connecting to or grounding the circuit has a very strong spring insuring good contact and can be easily removed and placed in any desired part of the work to be burned.

Advantages of the Transformer Over Gas.

The transformer has several advantages over gas burners.

It weighs only 25 lbs. complete and is portable. An iron strap is fastened on the case in such a way as to form a convenient handle for carrying, and to form convenient hooks for hanging the conductors while not in use.

The following shows to some extent what applications the lead burning transformer is adapted for, where it is more satisfactory to use than gas:

Lead Burning Transformer.

(1) A car enters the garage to have the battery recharged and it is discovered that the binding posts and wires are so badly corroded that it is necessary to cut them off. If a lead burning transformer is used in the garage, it can be carried to the car attached to the nearest socket and the posts can be easily melted off or the lugs unsoldered from the cable very quickly without the least danger of injuring the battery or setting fire to the car. The present means of removing these posts when corroded is a hack saw.

(2) It is discovered that the battery has a short circuit in it, and it is necessary to dismantle it, which necessitates the removal of all straps. The present practice for removing straps is to use a brace and drill. With the lead burning transformer, the joints can easily be softened up at the center and pried off with much less labor and in less time.

(3) Upon rebuilding the battery, it becomes necessary to build up the posts. If a gas burner is used, it is necessary to clean the posts very carefully, so that the lead will fuse together and form a good joint. This, however, is not necessary with the transformer. The tip of the carbon being only 1/8 inch in diameter can easily be inserted in the ferrule or asbestos, which ever method is to be used in building up the posts without any danger of burning the post loose from the battery, which trouble is often experienced with gas. The heat is more intense, and on account of the intense local heat will float on top of the molten lead as slag. The carbon point can be worked into corners where a flame cannot be handled easily.

(4) In melting straps to posts, unless the proper mixtures of gas are used, there is danger of the strap becoming too hot and the sides melting, caused by too large a volume of heat which cannot be centralized. With the carbon the heat is concentrated at the point of the carbon.

(5) The application of the transformer does not stop at the garage or around automobiles. It serves very nicely as a means of soldering or "sweating" on terminals. In removing terminals on account of the concentrated heat the cable covering is not damaged as with the blow torch. Splices in wires can be soldered and practically any kind of tinsmith work can be done with the outfit. Brazing can also be done, placing the work between a blunt carbon and cast iron.

During the process of lead burning or soldering, the maximum consumption of the transformer is approximately 800 watts and the maximum current drawn from the line about 10 amperes It should be remembered that the service is intermittent and that practically no power is being drawn except when work is actually going on. The core loss of the transformer is only 4 watts, so that the cost of energy when the transformer is connected to the line, but no work is being done, is practically negligible.

Cost—Electric vs. Gas Burning.

A comparison of the cost of gas and electricity is decidedly in the transformer's favor. At one garage where a comparative test was made, the present cost of 200 cu. ft. of acetylene gas was $1.50, express charge of 50 cents on the tanks and a rental of 50 cents per week after 30 days. With this amount of gas, approximately 30 batteries having an average of 210 joints could be repaired. The same amount of work was done with the transformer for 75 cents or less, a saving of at least $1.25 over gas, or a saving of 62 per cent. The current was figured on the basis of 5 cents per kilowatt hour.

A comparison of the cost of gas and electricity at another garage using oxy-hydrogen showed better than a 50 per cent saving in favor of the transformer.

Saving in Time.

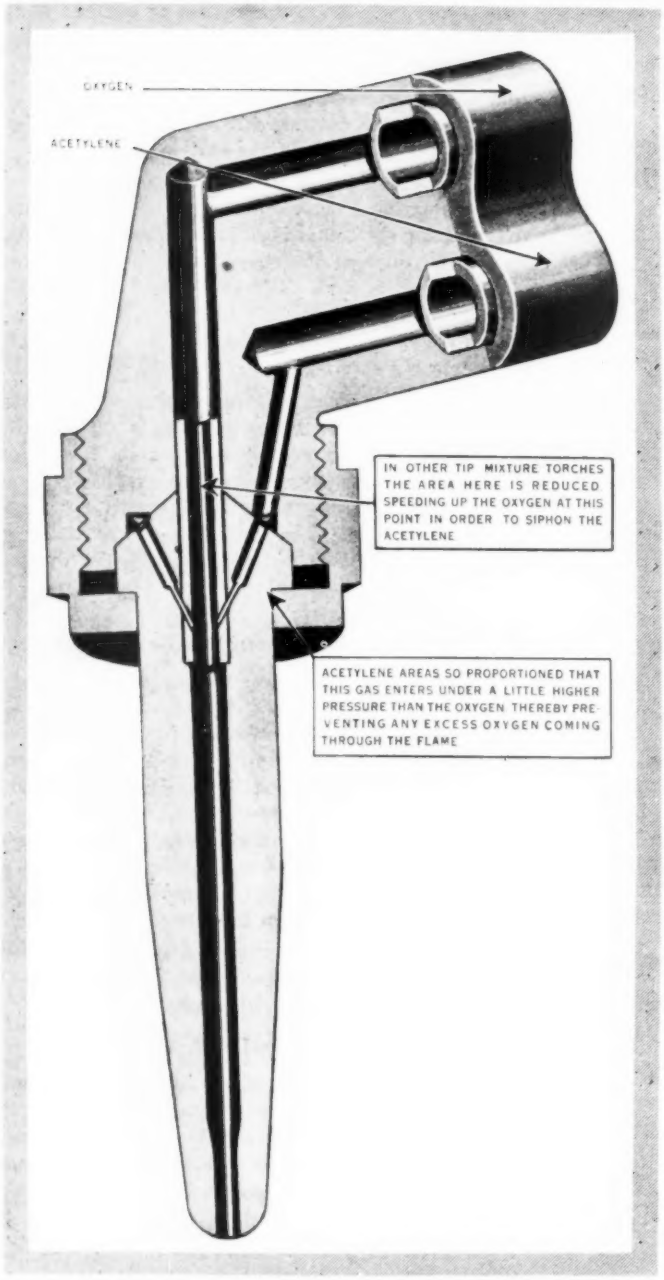
There is an additional saving in time which amounts to considerable. The time required in making a joint with gas is from 2 to 3 minutes. With the electric method the time for making a joint varies from 20 seconds to 1½ minutes, averaging around 1 minute, or about half of the time saved over the use of gas.

Commercial Possibilities.

There are about 25,000 service stations in the United States where they are repairing storage batteries daily. Each of these should have two or more of these outfits in their equipment.

The Exide Station, the U. S. Battery Station and several other places in Fort Wayne are using transformers, and the operators after a little experience have become so familiar and pleased with the manipulation of the transformer outfit that the use of oxy-acetylene has been abandoned.

WELDING AND C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Why does the **REGO** torc ke **flashback?**

Because of the **discovery** tha al **the oxygen conduit** to the g

Prior to this discovery, oxy-acety eld had always been constructed w ide oxygen inlet should be **small** an cety **large**—so that the oxygen woul e p the gases come together—speed mi this speed would be greater tha ackv propagation.

Sounds all right on paper BUT th bui flashes easily. Just bring the la me to the molten metal and BANG! fore of speeding up the mixed gases by of a gen pressure would seem to be i

Remember, too, that the oxy-a fla **consume exactly equal** quantitie gen **lene** and that all oxygen in exce ual not only **wasted** but enters the li eldin as an oxidizing or burning agent.

If the oxygen pressure is two, three or es as acetylene pressure, does it sound reason gue th tities consumed will be equal? Isn't it assu oxygen will be in excess in volume a n pre

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elding at Less Cost

ke a **better weld—use less oxygen**—and **eliminate the**

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REGO mixing chamber so proportions the areas of the passageways carrying the oxygen and acetylene that the acetylene comes through the areas half the size of the oxygen conduit and at a slightly higher pressure.

This principle dams (or holds back) any more oxygen coming through than the exact quantity necessary for the first stage of combustion, which is exactly equal volumes.

This principle eliminates the flashback; for each time a flashback is imminent, **the acetylene shuts off the oxygen** completely or partially and as acetylene alone won't burn and because the backward flame propagation of a "rich" mixture is less than a "lean" mixture, **the REGO torch won't flashback.**

An equal pressure torch cannot do this. A torch using the oxygen under a higher pressure cannot. The acetylene pressure **at the mixing chamber** must be greater than the oxygen so that the oxygen is dammed or shut off—**that's the REGO principle.** That principle is protected by U. S. Patent 1,301,044.

There isn't any logical reason why you should continue to use an excess of oxygen (which you pay for) harmful to good welding and be annoyed by flashbacks which are ruinous to successful welding.

A trial in **your** shop will prove the advantages of the REGO principle.

ESSING COMPANY
T LA SALLE STREET CHICAGO.

AN AMERICAN WELDER IN FRANCE.

Being the experiences of Robert B. Dyar, of the Davis-Bournonville Co.

Shortly after a state of war was declared to exist between the United States and Germany, a commission was sent over to France to find out just what their condition was and what were the first steps that America would have to take as an active partner on the side of the Allies. One of the things that this commission discovered was that the railroads of France were already badly overtaxed and that rolling stock in a very rundown condition, which made it impossible for them to assume the additional burden of transporting the American troops with their necessary supplies of food, ammunition, clothing and other things essential to the upkeep of an army. They, therefore, immediately sent to America a call for railroad engineers, and in answer to this call nine regiments of engineers were formed in nine of our largest cities. These regiments were composed mostly of men taken directly from the railroad shops, such as engineers, firemen, brakemen, all kinds of mechanics and, of course, a necessary number of clerks, draftsmen, etc. The particular regiment which I enlisted in was known as the 19th Engineers (Ry.) formed at Philadelphia, Pa., and consisted mostly of men from the Pennsylvania R. R., the New York Central R. R. and the Baltimore & Ohio R. R. Our outfit was the only one of the nine which was known as a shop regiment, the other eight being designated as construction regiments. I enlisted on May 21st, 1917, as an oxy-acetylene welder and cutter and was called into service on June 3d, reporting at the Commercial Museum, Philadelphia, Pa., as no training camps were as yet completed. We were put through two months of squads east and west and everything that goes with the process of changing a from a civilian to a soldier, regardless of whether his nature fitted him for a soldier's life or not. We were finally shipped from New York on the British Troop Ship "Saxonia" on the 9th of August, 1917.

Oxy-Acetylene Welding Dept. "A," M. T. C., A. E. F., Capt. Geo. J. Fouser, commanding, is the officer at the desk in the middle. Serg't A. K. Morgan sits behind him.

Those of you who have been over, know what a world of meaning there is in the words "British Troop Ship" but for those less fortunate, I will explain that it is usually your first real experience in the horrors of war. Below decks the air is like a room after a well-attended "smoker" has been pulled off to which is added the smell of spoiled food, to say nothing of the various odors added by your sick comrades, all of which blended together make it the last place on ship you really want to go to and yet you can't stay on deck all of the time so you try to kill time by sleeping and spending most of your waking hours walking the deck to work up an appetite which you immediately lose the minute you get a whiff from the mess-hall, and if you happen to be seasick your [illegible] Lord—mere words cannot express how miserable you get.

We stopped off at Halifax after being lost in a fog for 36 hours, during which time we were reported as sunk, where we joined our convoy of five other boats, three of which were transports and the other two supply ships and finally landed at Liverpool, England, on August 24th. Our first sight of a foreign shore was most thrilling and we all yelled ourselves into a nice sore throat. At Liverpool we were put directly on to trains and sent to Camp Borden, which was a part of Salisbury Plaines, not far from London. Here we were put into tents and given a four-days' rest during which time some of us had a chance to visit London and see some of the surrounding country. This was also our first chance at a real bath in nearly three weeks as a tub could be rented in town for the sum of six cents. Here we also had our first glimpse of the soldiers of England and her colonies. The Tommies were a little reserved and their sargents were shocked at our familiarity, but the Canadians and the Australians welcomed us like brothers. Our last night at Borden it stormed something awful, our mess tents and some of the squad tents blew over and the next day we left, through a sea of mud, for Southampton. We then took a little side wheel cattle boat and after a wild up and down trip across the Channel landed at LeHavre, France, on August 30th, 1917.

We were put into a British rest camp where we were well fed and house, and after five days Company "D," to which I belonged was sent to Sotterville, a small town near Rouen, where there was one of the largest railroad repair shops in France. On our arrival we were billeted in a half-finished schoolhouse that had just been vacated by several companies of Algerian colored troops. The place looked nice and clean and the bed sacks well filled with straw, looked inviting, but the next morning we found that the Algerians had left a large colony of their special brand of "cootie" and these little pets gave us the heartiest welcome we had yet experienced.

The following morning we were all taken on a tour of the shops and I was very much excited to find two welding shops, one small one and another of a fairly good size. In the afternoon those of us who had regular trades reported to the French in charge of the shops. None of us could talk any French and they could talk but very little English, so the only way we could make any headway was to get out several catalogues and by pointing to the pictures we made them understand what line of work each man was qualified for. They had no catalogues on acetylene welding so I brought down Mr. S. W. Miller's book on that subject and very quickly made them understand what my particular line was. I was told to report at the small welding shop the following morning at six o'clock and was entered on the shop records as a "Soudeur Autogene," which is French for acetylene welder. The French were working eleven hours a day and as we were located some distance from the shop we had to get up at 4:30, breakfast at 5:00 and be on our way to the shops by 5:30. We had an hour and a half for dinner and supper was at 7:00. The first day I reported on time and was turned over to a Mr. Boulonge, who was very much excited over the idea of an American coming to work with him. First of all he introduced me to everyone working near the shop, which by the way was

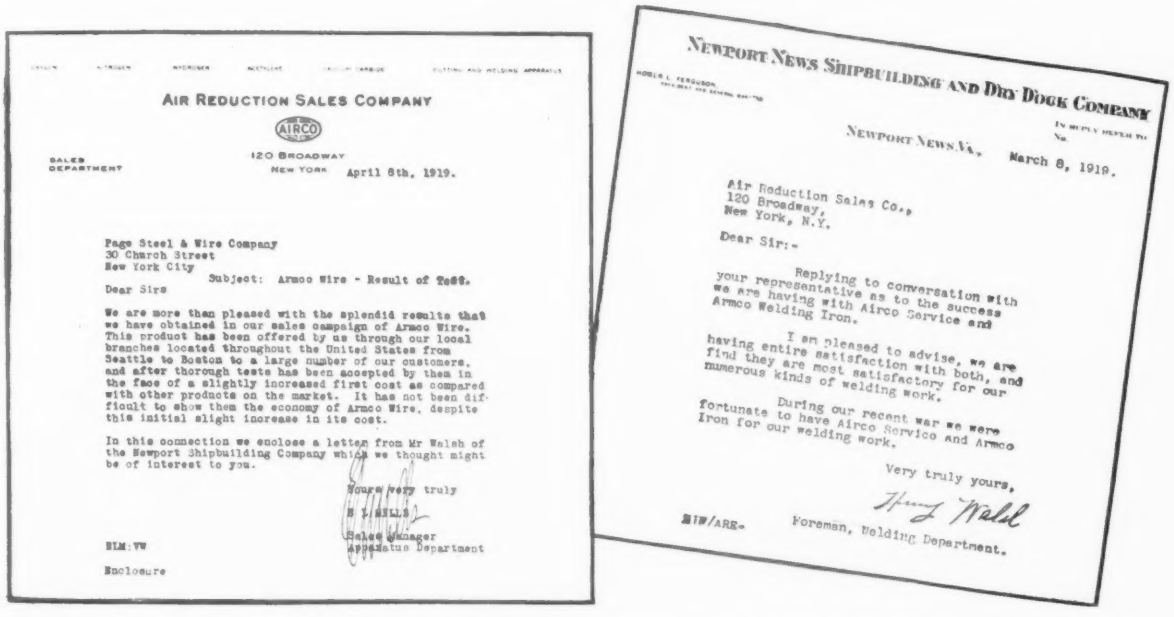
ARMCO IRON WELDING RODS

AMERICAN ARMCO INGOT IRON

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by the American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

cost somewhat more than ordinary filling material, but, compared with the total cost of the weld, the difference is insignificant. The difference in strength and safety of the weld, on the other hand, is of vital importance.

"It has not been difficult to show them the economy of Armco Iron Wire—"



AIR REDUCTION SALES COMPANY

AIRCO

120 BROADWAY

SALES DEPARTMENT NEW YORK April 8th, 1919.

Page Steel & Wire Company
30 Church Street
New York City

Subject: Armco Wire - Result of Test.

Dear Sirs

We are more than pleased with the splendid results that we have obtained in our sales campaign of Armco Wire. This product has been offered by us through our local branches located throughout the United States from Seattle to Boston to a large number of our customers, and after thorough tests has been accepted by them in the face of a slightly increased first cost as compared with other products on the market. It has not been difficult to show them the economy of Armco Wire, despite this initial slight increase in its cost.

In this connection we enclose a letter from Mr Walsh of the Newport Shipbuilding Company which we thought might be of interest to you.

Yours very truly

H. L. Mills
Sales Manager
Apparatus Department

HLM:VW

Enclosure

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

NOBLE L. FERGUSON

IN REPLY REFER TO No.

NEWPORT NEWS, VA., March 8, 1919.

Air Reduction Sales Co.,
120 Broadway,
New York, N.Y.

Dear Sir:-

Replying to conversation with your representative as to the success we are having with Airco Service and Armco Welding Iron.

I am pleased to advise, we are having entire satisfaction with both, and find they are most satisfactory for our numerous kinds of welding work.

During our recent war we were fortunate to have Airco Service and Armco Iron for our welding work.

Very truly yours,

H. L. Walsh

HLW/ARE- Foreman, Welding Department.

The above typical letter to one of our distributors shows that the superiority and real economy of ARMCO welding material are readily appreciated. Welders who use ARMCO IRON exclusively have a big advantage over competitors who buy inferior filler and their customers soon learn the difference.

Another ARMCO advantage from the welder's standpoint is the fact that two kinds of rods of guaranteed ARMCO analysis, one specially treated for electric and the other for oxy-acetylene welding, do all the work (with better results) that heretofore has required a choice of one from many compositions. This means that with a much smaller investment for stock of filling material a shop is fully prepared to handle the usual run of steel and iron welding work.

Because of their exceptional purity and even density Armco Iron Welding Rods flow freely, weld evenly, and give a joint that lends itself perfectly to hammering, forging, and, where necessary, to annealing and quenching.

Our booklet on "Armco Iron Rods and Wire" is full of interesting and useful welding data. Send for it.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

STEEL AND WIRE PAGE QUALITY PRODUCTS

Makers of "Copperweld" Copper Clad Steel Wire; ARMCO Iron Welding Rods and Electrical Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stock-room Partitions; Architectural Iron.

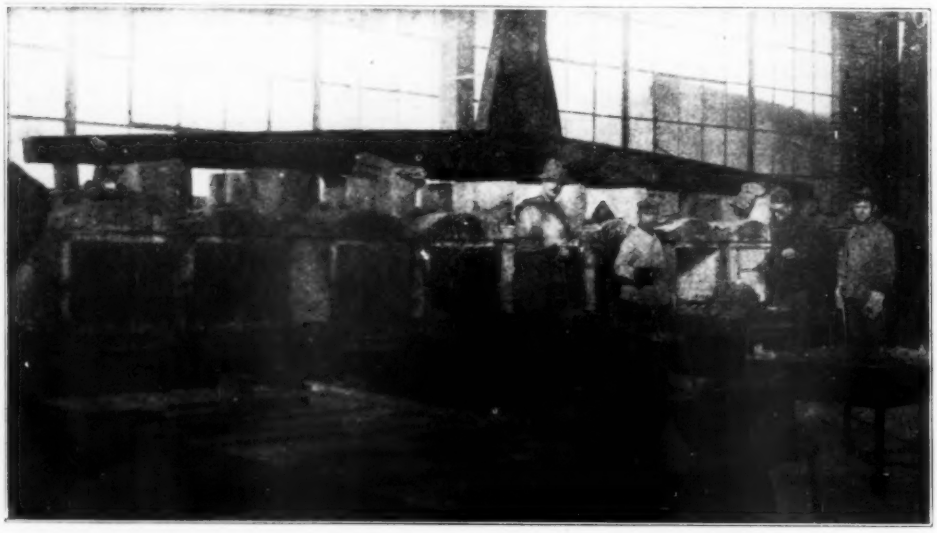
Plants: Monessen, Pa., and Adrian, Mich.

Sales Offices: 30 Church Street, New York

Pacific Coast Representatives: American Rolling Mill Company, San Francisco
Canadian Distributors: Taylor & Arnold, Ltd., Montreal and Winnipeg

STEEL AND WIRE PAGE QUALITY PRODUCTS

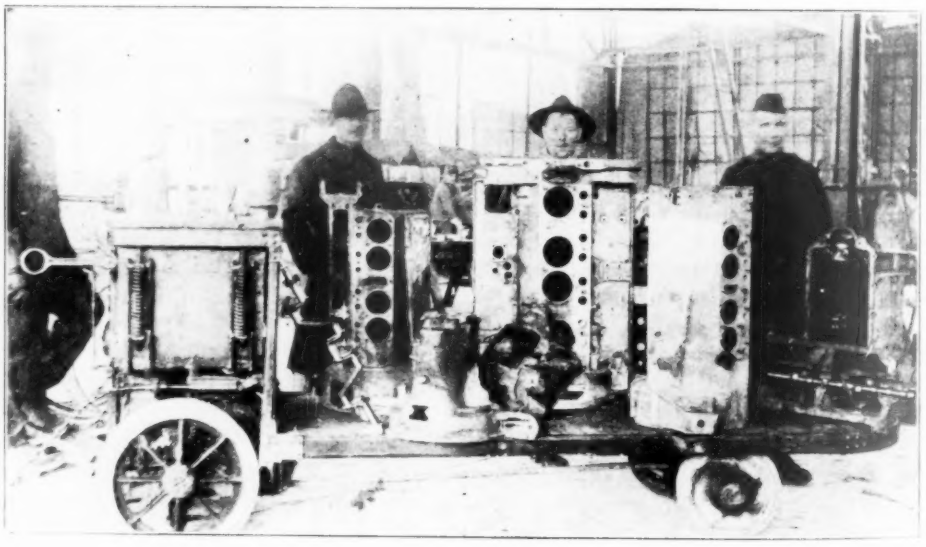
in one end of the tin shop. They were all quite cordial and very curious to know all about America. We then went to interview the timekeeper and I was given a large brass tag with my name and number on and by the use of gestures and the aid of several other men, I was told to remove the tag from the time board when I came in each morning and noon and to put it back when I left each noon and evening. After this was all thoroughly explained to me, my friend took me from shop to shop introducing me to everyone. There were a number of women and girls working in the shops and he took great delight in introducing me to them. They all seemed to get a lot of fun out of the proceedings and were very cordial and also very curious. Before going into a new shop, he was always very cautious about seeing who was there and several times we made wide and rather quick detours as he was afraid of meeting the "Grand Chief" or big boss as we would call him. I found out later that all of the workmen were under military control, really a part of the French Army and if they didn't behave themselves, they were apt to be sent up to the front. As most of them had been there already, they were not very anxious to be sent back. That afternoon we looked over the equipment and charged the generator. They had only two torches, one very much like the Prest-O-Lite of today and one old Fouche torch with a wooden handle and the oxygen tube curling around the tip to preheat the gas. They also had about three quite old oxygen regulators, several pairs of goggles like small spectacles and some welding rods. Neither of the torches were as good as most any of our standard makes and had no values at all, the regulation being done at the oxygen regulator. The generator held about 40 pounds of carbide and was one of the old water to carbide types, giving acetylene at about four or five pounds pressure. The large lump carbide was put into two drawers which slid into the bottom of the generator and the water flowed into these generating the gas which passed through a number of water seals and cleaners, to the welding shop. I found that the regular welder was sick and that I was there to take his place until he was able to get back to work. They did very little welding in this shop, mostly small cracked or broken castings, a little sheet iron work, some repairs on split pipes and two regular jobs, one being to weld together the ends of a small wire ring put in the end of a short chain, and the other to weld a small steel pin in one of the cast iron parts of their brake couplings. This shop was also an overhauling station for some of the British Hospital trains and I did several small jobs for them. We also did some personal work for the men from various parts of the shop as they nearly all had some little thing they were making for their home use, mostly souvenirs of one sort or another. I learned quite early in the game that it was the custom to shake hands with everyone on coming to work in the morning, from the man at the gate to the lowest apprentice in the shops. After I had been there about three weeks, the regular welder reported for duty and I was transferred to the larger shop which I will describe to you another time.



Preheating Oven in France (described in May issue). Note two prisoners of war.

The Harris Calorific Company of Cleveland, Ohio, have issued a handsome new catalogue covering their list of high temperature gas apparatus. The catalogue describes various types of cutting and welding torches, regulators, carbon and lead burning outfit manifolds and miscellaneous supplies and apparatus.

The practice of welding automobile springs is not recommended. Auto springs require after heat treatment, or uniform tempering. Breaks in auto springs may often be welded in emergencies, and sometimes such welds hold for some time, but such welds should only be attempted in emergencies.



Finished work in France, ready for machine shop. Illustrations by Courtesy of Serg't A. K. Morgan.

Much has been printed on the subject of successful preheating. In fact we consider this phase of welding a most vital point. Attention is therefore directed to the description and illustration of preheating furnaces used by the M. T. C. in France, as described in *The Welding Engineer* of June.

SWEDOX WELDING RODS and WIRE

Testing Sample FREE

We want every welder in the country—big or small—to be convinced of the *specialized superiorities* of SWEDOX products. And we know that a trial *will* convince you. Hence the free offer. Try SWEDOX on your next welding job at our expense.

No matter what the job is, there is a SWEDOX product especially made for it. We sought and obtained from the nation's expert metallurgists and welding engineers the best analysis for each task. Science has put into SWEDOX rods and wire the proven betterments that make them the recognized standards in every case.

You'll find SWEDOX products free from impurities, uniform in analysis and therefore economical because their use reduces the cost of application and of machining.

And we'll send you a sample, at our expense, enough for a thorough test—one which should prove to you, as thousands of welders know, that SWEDOX products are the standards.

Pin the coupon to your letter head fill it out and mail to us, and we'l ship at once, carriage prepai d, th particular product you want.

CENTRAL STEEL & WIRE CO.
Dept 22—119 N. Peoria St., Chicago

We operate ..... welding machines.
Give number

Electric ☐ Acetylene ☐

Send your FREE testing sample for .....

Kind of job to be welded

Name SIZE of wire .....

Firm Name .....

Street Address .....

City and State .....

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Purchasing Agent

Swedox Welding Products

Nonox — For Acetylene Welding
Lektrox — For Electric Welding
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Vanox — For Vanadium Metals
Nickox — For Nickel Welding
Kromox — For Chrome Nickel
Railox — For Frog Switch and Crossings

Central Steel & Wire Company

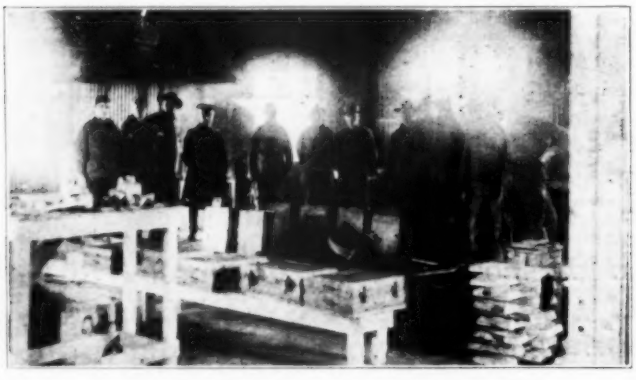
Dept. 22, 119 North Peoria Street, Chicago

ELECTRIC AND OXY-ACETYLENE WELDING*

By M. J. O'Connell

The problem of fastening two or more plates or pieces of metal together is one of the fundamentals of construction, whether it be in building a machine, a bridge, a skyscraper or a ship, and the methods practiced are forging, riveting and latterly welding, whether by the hammer and anvil, the electric or the gas methods. The forge welded joint is the oldest known and gives the greatest tensile strength, comparing equally with that of the original plate, for the reason that the particles of the metal are hammered and bonded together through pressure, but its application is limited owing to the impracticability of forge welding on vessels or tanks made of plate.

The tensile strength of the riveted joint is considerably less than the original plate; for instance, two pieces of plate joined with four rows of rivets and double straps will not exceed 85 per cent of the strength of the original plate. In comparison to this, a continuous electrically welded butt joint with single strap alternately tacked, that is welded in short stretches reinforcing the principal seam, will give greater tensile strength than the original plate and cost about one-half that of the riveted. This statement may seem by some to be exaggerated, but is nevertheless true and has been proven after extensive



Officers and Men of Dept. A, M. T. C.

Welding Shop in France, Dep't A, M. T. C.

tests made by the British Admiralty and the United States Bureau of Standards.

We have in operation in our plant various types of electric welding machines using 110-volt alternating current, machines of "Holslag" transformer and "Quasi-Arc" resistance types and 220-volt direct current "Wilson" and also "Lincoln" motor-generator sets. This current is modified through the machines to 15-35 volt, 100-150 amperes suitable for welding. The alternating current machines are really the practical type of welding machines for shipyards service; occupying only about 12 cu. ft. of space and weighing little more than 200 lbs., they are easily moved about to the desired location. We usually place them on the keel blocks about midships of the hull from where the leads can be run fore and aft, thereby using the least possible amount of cable. The low voltage on the primary side of this type machine is also a factor of safety for the operator or whomsoever might accidentally come in contact with a live cable.

The 220 volts direct current motor-generator sets are located between the shipways at the river end, erected on push cars and covered by shelter houses to properly protect them from damage by storm. These sets consist of a motor and generator together with switchboards and operating panels and weigh about one and one-half tons, so that portability being difficult, they are rarely moved.

The general effort in electric welding work is to maintain a constant current at the arc, so that when the operator has his machine adjusted to the service required, he may be reasonably assured there will be no fluctuations in his supply of power. The positive cable is attached to the work while the negative is the electrode side held by the operator. The current passing from the piece to be welded to the electrode forms an arc, the excessive heat of which brings the metal to which it is applied up to a white heat, the metal of the electrode at the same time penetrating into and adding itself by fusing with the pieces to be welded. In order to obtain this very much desired result our shipways are wired especially for welding service.

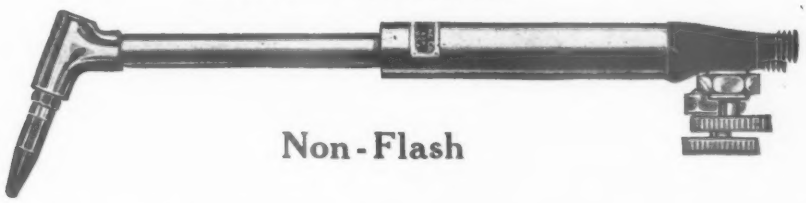
The following list of ship parts are approved and recommended for electric welding by Lloyds Register of Shipping and the American Bureau of Shipping:

Deck rail stanchions and plating.
Clips for detachable rods (joints).
Attaching deck collars (L rings around ventilators).
Attaching deck collars (L rings around stacks).
Attaching cape rings, smokestacks, pipes, etc.
Attaching galley fixtures to plating.
Attaching bath and other fixtures in Officers' quarters.
Attaching cowl supporting rings to ventilators.
Bulwark top splicing and end fittings.
Skylights over galley.

(a) Engine rooms, stairs and gratings.
(b) Boiler rooms, stairs and gratings.
Attaching (a) and (b) to plating.
Grab rods on casings.
All stairs and ladders including rail attachments, door frames to casing, hinges, catches, wash hooks, etc.
Clips for attaching interior wood finish to casing.
Entire screen bulwark.
Coal chutes.
Butts of W. T. and O. T. Boundary bars on bulkheads or floors in double bottom.
Ventilator cowls.
Stacks and uptakes.
Bulkheads (that are not structural parts of the ship), portition bulkheads in accommodation.
Framing and supports for engine and boiler room flooring or gratings.
Cargo batten cleats.
Tanks (that are not structural parts).
Shaft alley escapes.
Steel skylights over accommodation spaces.
Engine-room skylights.
Grab rods on exterior and interior of deck houses.
Deck houses not covering unprotected openings through weather decks.
Reinforcing and protecting angles around manholes.
Joints of W. T. angle collars at frames in way of W. T. flats.
Other parts of vessels in which electric welding is proposed must be submitted for consideration.

*From the Federal Shipbuilder.

Oxy-Acetylene U.S. Welding Apparatus



Non-Flash

A Welder, with a "U. S." torch actually approaches a "Tight Place" or "A Job Too Big For The Other Fellow," with something akin to joy.

One of the first things he learns about "U. S." torches, is that he can rely implicitly upon them at all times to *remain lighted and never flash back.* Their remarkably smooth, soft, yet highly tempered flames, win admiration and high approval by particular operators and permit them to make better welds in much less time and save more gas than with any other apparatus.

Such performance ought to be called extraordinary. It is a regular thing with "U. S." torches, which helps explain why each one sold, sells another.

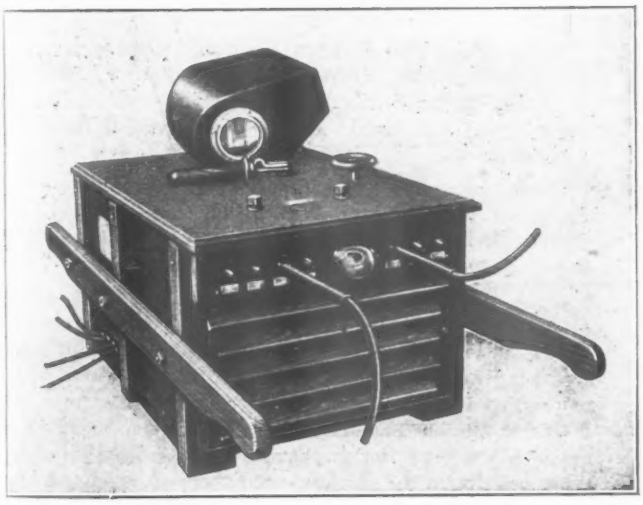
Have you ordered yours? To work without them is a continual loss.

Price "U. S." Welding Torch No. 3, with Copper Tips.....$35.00

(Different angle heads and lengths for boiler work)

UNITED STATES WELDING CO., Inc.

Minneapolis, Minnesota



A WELD

That will give high TENSILE STRENGTH and DUCTILITY can be made by our PORTABLE ALTERNATING CURRENT WELDER.

TESTS of our welds give over 100% RESULTS.

Only real portable machine. No costly wiring systems. No cost of maintenance—no moving parts. Uses any type electrode. Designed for any A. C. power supply. High penetrative qualities. Operates in any position.

What kind of welding wire do you use?

Do you want the best at a low cost? Send for sample or give us a trial order.

OUR CATALOGUE NO. 104 DESCRIBES OUR WELDER AND CONTAINS PLENTY OF VALUABLE INFORMATION. SEND FOR IT!

Electric Arc Cutting & Welding Co.

222 Halsey Street, Newark, N. J.

The above recommendations were made about a year ago, since which time others have been added, but the above covers in a general way all parts of new construction where electric welding is recommended.

An excellent example of the efficiency of electric welding is offered by the British Admiralty, who directed the construction of a complete electrically welded barge of two hundred tons deadweight, one hundred twenty-five in length, sixteen feet in breadth. This barge was constructed at Richborough, England, to demonstrate principally the practicability of electric welding on ship plating. This barge has now been in continuous cross channel service for about a year, subjected not alone to the severe stresses and strains of the well-known English Channel currents, but has also withstood the additional strains of towing during this time without developing a leak. On the strength of this remarkable demonstration, preparations are being made to construct a vessel of about five thousand tons in one of the Eastern shipyards of this country. This vessel will be a combination of welding and riveting, depending upon the economy of operation applied to various sections.

Other notable electric welding operations was the repairing of numerous cast iron parts, including the large engine cylinders, circulating pumps, condensers, casings, etc., on the steamships "George Washington" (the President's ship), the "Leviathan" (formerly the Vaterland) and the "Pocahontas" (formerly the Princess Irene) and many others which had been supposedly irreparably damaged by the German crews prior to our entry into the war who with sledges had cracked and broken immense pieces of the cylinders entirely away, in order that the damage would seriously delay the United States in placing these vessels in commission. One case particularly is deserving of illustration, on which the estimated repairs amounted to $32,000, and the time required about ten months, including the making of new patterns, the casting and machining of the new cylinders. As the value of the services of the steamship at that time was about $1,500 per day, plus the $32,000 estimated cost of repairs, it can readily be seen that the loss of revenue to the Government would be approximately $450,000. In contrast to this the repairs were made by electric welding on the damaged parts at a cost of $1,900 including towing charges of the welding barges and the parts were completed and ready for service in about ten days. This vessel has been in constant service ever since, using the same engines with the same welded cylinders and has made probably more than twenty trips to the other side.

The U. S. S. George Washington has become famous through being chosen to carry President Wilson to and from the Peace Conference at Paris, while the U. S. S. Leviathan is well known as the largest ship afloat, and has a carrying capacity of about 14,000 persons. They are both engaged in transport service and considering the valuable cargoes they carry, the navy department surely must have been confident of the quality of welding on the engine parts.

We have reclaimed a number of heavy parts for our ships which would have otherwise been rejected.

A good example of electric welding on plate work may be seen on the air receivers at our power house, the seams of which are welded.

A great deal could be written on the subject of Oxy-Acetylene welding, which method is practiced by us principally on castings. The objection to this method on plate work is that the excessive heat is generated through the plate for a considerable radius around the operating point, causing a disintegration of the steel particles in the plate, thereby reducing its strength. Electric welding for this reason is approved and recommended on all plate work, as its heat contact is extremely localized and actually boils to a fusing point only at the spot where the electric arc is applied. Preparation by chamfering or beveling the edges of the plate is necessary to good welding. The edges should also be clean. This enables the operator to penetrate through to the bottom of the material and assures a complete binding of the two pieces that are to be joined together. It also gives a flat surface at the proper angle, enabling the arc or gas heat to penetrate squarely into the material. We are constantly repairing parts for machine tools and equipment by the gas method, where it is usually necessary to preheat on a charcoal fire the material to be welded in order to equalize the internal strain and in this way insure a more gradual contraction of the material to its original cast after expansion by letting it die out on the fire. This preheating also materially reduces the cost of operation as it saves acetylene and oxygen which otherwise would be consumed in bringing the material up to a welding temperature. By this Oxy-Acetylene process the writer directed the welding of the wheel trucks and chassis of the first Edison Electric Storage Battery car, which has been in cross town service in New York City for about eleven years.

We have our own generating and compressing plant for acetylene gas and manufacture most of that consumed in the yard. This Oxy-Acetylene combustion is the method by which the burner cuts through the plates so easily and rapidly that he is known as the most popular and is probably in greater demand than any other operation in the yard. He is the chap who always gets the job "that's gotta be done right away."

For both welders and burners suitable lenses are supplied to protect their eyes and extra precaution should be taken by those working in the vicinity of the electric welder that they do not watch the arc as it is very injurious to the eyes.

When this department was first established it was very difficult to secure experienced operators for either welding or burning, and we were practically compelled to install our own school of training from the first, graduating the operator by degrees until he became a first-class mechanic. We find considerable satisfaction in the fact that 85 per cent of our operators at the present time are products of our own plant and are known as "Federal men," trained with the predominating idea that they must be capable and willing at all times when called upon for service.

The International Oxygen Company wish to announce the appointment of Mr. Preston Belvin as District Sales Engineer in charge of the Pittsburgh district sales work. The office of the company will remain at 1310 First National Bank Building, Pittsburgh, Pa.

They wish to announce further that their Chicago office, in charge of Mr. Philip G. Wesley, has been removed from 22 Railway Exchange Building to 817-820 Chicago Stock Exchange Building, 30 N. LaSalle Street, Chicago, Illinois.

The Sutton-Garten Company of Indianapolis, Indiana, who are the distributors for Prest-O-Lite oxy-acetylene equipment, report that their company is experiencing a very rapid growth. Both Mr. Sutton and Mr. Garten are former members of the Prest-O-Lite organization, having been in charge of departments relative to the services given users of Prest-O-Lite equipment. They are, therefore, well equipped and trained to look after the needs of welders in their territory. This company carries a large and complete stock of apparatus and supplies and are also preparing to give engineering advice on all subjects relating to welding.

NEW HARRIS CATALOG

The Harris Calorific Company of Cleveland, Ohio, has issued a handsome new catalogue covering their list of high temperature gas apparatus. The catalogue describes various types of cutting and welding torches, regulators, carbon and lead burning outfits, manifolds and miscellaneous supplies and apparatus.

WELDING SPECIALISTS

Leading Welding Shops of the United States, equipped to handle unusual and difficult welding and cutting work. We send men anywhere and guarantee work. Prices reasonable. Correspondence solicited.

ONE of the largest and best equipped job welding shops in the United States. Our men are experts. No job too large or too complicated. Work guaranteed—prices reasonable.

When in trouble send for our man

Torchweld Equipment Co.
Fulton and Carpenter Streets, Chicago

Portland Brazing & Machine Wks.
266 Glisan Street
PORTLAND, - - OREGON

The Big 4 process Shop

Electric—Thermit—Oxy-acetylene and reinforced brazing.

The Northwest Distributors of REGO Apparatus

Rochester Welding Works

We not only do welding, but supervise the design and installation of oxy-acetylene welding plants; report on welding material and methods; make tests on welding apparatus for efficiency and economy.

Nine years' experience.

Rochester Welding Works
349 Orchard St., Rochester, N.Y.
S. W. MILLER, M. E., Proprietor

Davis-Bournonville Co.
147 W. Austin Ave. Chicago

Davis-Bournonville Co.
Marion Jersey City

Davis-Bournonville Co.
316 Penn Ave. Pittsburgh

Texas Headquarters for Welding and Cutting. The Best Equipped Plant in the State.

Southern Welding & Machine Co.
212-14 College Street
San Antonio, Texas

WE weld broken machinery and auto parts. Aluminum crank cases a specialty. Welders and brazers of all metals. Custom welding for the trade. Let us figure on your requirements. Imperial Brass Mfg. Co., Welding Dept., 508-510 S. Racine Ave., Chicago, Ill.

M. C. GREEN
Consulting Engineer
Instructor in **pre-heating, welding, cutting** and **brazing.**
Manufacturer of **pre-heating, heat-treating, melting** and **brazing burners.**
Office and Demonstration Plant
325 Campbell St., Williamsport, Pa.

GOOD welding shops are an asset to any community. They should be encouraged and helped. The Editor of The Welding Engineer will be glad to have information and photographs relating to any successful job welding shop.

This page is intended to be a directory of America's best shops. The cost of advertising is low. Write for details.

The Welding Engineer

Reg. U. S. Pat. Office.

Published on the 15th of Each Month by

THE WELDING ENGINEER PUBLISHING CO.,
608 S. Dearborn St., Chicago, Ill.
Telephone Wabash 7134.

A. B. Mackenzie.....President and Editor

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Max I. Barth, Eastern Representative.

The Welding Engineer in Australia and New Zealand.

Mr. R. Hill, Matlock House, Devonport, Auckland, New Zealand, is our accredited representative in Australia and New Zealand for obtaining new subscriptions.

VOLUME 4. JULY, 1919. NUMBER 7.

Eye Protection.

IN commenting on a Government publication on Eye Protection, Professor Koppins, of Chicago University, says: There is no doubt that in using the oxy-acetylene flame, and looking at it with eyes unshielded, the condition is not normal, and some sort of disturbing effects result. Outside the volume or intensity of light, which is a personal matter, since some people feel perfectly comfortable in light of a certain intensity which would make other people feel uncomfortable, there is the question of short light waves coming. Normal eyes are so constructed that they can only perceive the light which is contained between rather narrow limits, that is from the longest red to the shortest violet. The longer waves are heated waves, and do not affect the eye in any other way except in intensity. But the shorter waves are the dangerous ones, since they are the chemically active rays, which will affect the eye on that account besides on account of their intensity. Just what the effect is depends upon the intensity and length of exposure. A relatively short exposure causes burns on the skin such as are caused by the sun, in fact, sun burns are produced by the short rays in the sun light. Prolonged exposure would, of course, cause more severe burns, and since, of course, the operator usually takes precautions when he is warned, the extreme effects are not known. It is safe to say, however, that the result is similar to that caused by X-ray burns, which, of course, are much more severe and has cost the lives of careless operators.

Regarding eye strain, that depends upon whether or not the person has normal eyes or not. I cannot see why the person who wears correct goggles should have any bad effects due to the ultra-violet light. Of course the goggles should be so constructed that any extraneous light cannot enter at the sides, since the sudden change in intensity would undoubtedly strain the eyes.

Filling Acetylene Cylinders.

WE have recently heard about a couple of welders who make a regular practice of filling empty acetylene tanks with oxygen in order to have a reserve supply of oxygen on hand for emergencies.

The man who fills an empty acetylene tank with oxygen takes his life in his hands. There have been many explosions resulting in death or terrible disfigurement caused by such a proceeding.

Without going into this matter on a very technical basis it might be explained that oxygen, in connection with any easily inflammable material, under even a slight pressure may cause spontaneous combustion. In the case of an acetylene cylinder, there is impregnated in the packing of the cylinder a highly inflammable material known as acetone. Thus you have the combination which will cause spontaneous combustion. If the cylinder valve is closed, this will result in a terrific explosion, strong enough to kill anyone in the same room and demolish buildings.

The fact that a tank has been filled, without anything happening, should not lead the welder to believe that the practice may be continued safely.

The Advertising Pages.

IT is rather unusual for the editorial department to make special reference to the advertising pages. We cannot, however, let this opportunity pass without commenting upon the really remarkable display in this number. Great changes have taken place in the advertising pages of the technical and business papers during the past decade. The manufacturers were formerly content with using advertising space largely for display cards in order to keep their names before the public. Gradually they came to a realization that it would be far better to use this space for educational purposes by setting forth in an attractive manner the functions and advantages of their products. The difficulty in many cases was that the manufacturers did not have the facilities for getting together the necessary material or of putting it into attractive shape.

A great editor used to say that the time would come when the advertising pages would be read in preference to the editorial pages because the advertiser, unhampered by those standards as to form which must necessarily be observed by the editor, would be able to make the material more attractive to the eye. The editors are not worrying, but so rapidly have conditions improved in preparing advertising copy that there is no question but what our readers will be forced to study the advertising pages critically and carefully. Unlike conditions 10 years ago, the copy is changed with each issue, thus helping to maintain the interest.

Zone Subscription Rates.

ONE of the world's greatest mechanical papers, *The American Machinist*, announces an increase in their subscription rates west of the Mississippi, on account of the advance in zone postal rates. That is because it costs more to send a paper to a subscriber in the far west than it does in adjoining states. We can write him a long winded letter, about nothing, at the same postal rate which governs here, or our congressman can send him a one hundred page reprint of his latest speech (without cost to him), but when he subscribes for a useful, helpful trade magazine, which helps him to become a more useful citizen, then somebody must pay the bill.

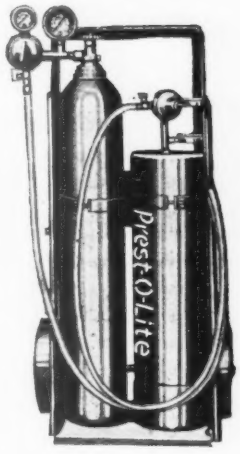
The Welding Engineer, as well as all other trade papers, must eventually adopt a zone subscription price, but we intend to put it off as long as possible. In the meantime we hope something will be done to repeal this unjust law.

UNIVERSAL ELECTROLYTIC CELLS

The Universal Oxygen Company, Sheboygan, Wisconsin, have gone into the manufacture of electrolytic cells and have developed a very efficient cell with all of the latest improvements. It is their intention to promote the sale of these generators and put in private plants for large consumers of oxygen and hydrogen gases. They are also building their own compressors, as well as all other equipment necessary for the installation of plants. Complete specifications are furnished plants from one thousand to ten thousand cubic feet per day.

Prest-O-Lite

More than 40 Plants and Warehouses Ready to Serve you



The Universal Gas with the Universal Service

PREST-O-LITE Service is a well-rounded, time-tested contract service, carrying obligations which the Company is bound to fulfill.

PREST-O-LITE Service is built on unique ability to serve—ample plant and cylinder capacity, great experience and a smooth-working, nation-wide organization—fundamentals without which service is no more than a name.

Some of the most valued heating applications in industry were inspired or developed by our Engineers. Their experience is rich in just such knowledge as may save you much loss through costly experiment or inefficient methods.

Prest-O-Lite

DISSOLVED ACETYLENE

The Gas of a Thousand Uses

has earned top place by force of organized knowledge and facilities.

If you have a metal-working problem, we are pretty certain to have a tested plan to submit—what to do and how best to do it. At your service whether you are an actual user or a potential user.

Send a sketch and data. We'll send the answer—fair and unbiased, professional rather than commercial.

THE PREST-O-LITE CO., Inc., General Offices, 42nd St. Building, New York City
Kohl Building, San Francisco

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FIRE BOX WELDING

By B. K. Smith*

THE development of the oxy-acetylene process of welding and cutting in the last few years has introduced a new and spectacular application: The welding of entire fire boxes. The superiority and low cost of this type of joint is unquestionable, and the field of this application of the process is growing steadily. As the process becomes better known among the boiler shops, it is accepted by foremen, superintendents and owners of boilers as a decided factor in decreasing the maintenance of fire boxes.

The Riveting Process.

The riveting process consists of lapping two sheets about two or three inches together, riveted and corked at the edges.

In heating a riveted fire box, the water will not protect the lapped joints exposed to the fire; nor will the heat penetrate to the lapped Joint at the water side. With the riveted Joints, we have to contend with two thicknesses of plates, rivet and the mill scale between. We all know that the mill scale or mill oxide is a non-conductor of heat and is acting as a barrier between both sheets. The consequences are that the sheet ex-

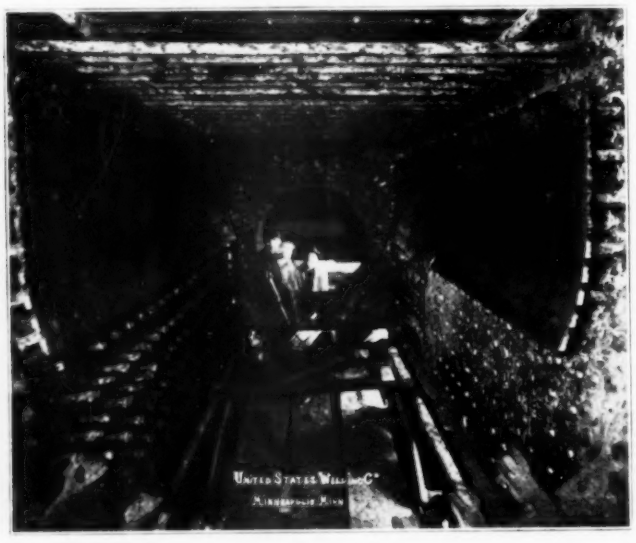


Fig. 1.

posed to the fire will crystallize and crack from the rivet hole to the edge. At this stage it will begin to leak more or less, and the steam pressure will act as a wedge and force its way between the lapped Joint and crack the next rivet hole, and so on until the whole seam exposed to the fire is defected. However, the greatest evil is when the fire cracks begin to leak with more force, the steam will reach the adjoining solid metal and burn or peel off the sheet, until it becomes as thin as paper. Therefore, it is necessary to stop the leak from fire cracks in time before the adjoining plate gets steam burnt. The only remedy the boilermaker has is the corking tool, but this acts on a boiler about the same as toothache drops will act on a well decayed tooth. While it may in some cases stop the leak for a very short period, but sooner or later it will leak with greater force. The only improvement that can be made with the riveting process, is to ground off the mill scale at the laps and fit both sheets similar to a ground valve seat. But where is the boilermaker who will take the time and trouble to perform this work? In many cases the author has seen lapped Joints before riveting, separated or sprung away about 3/8 inch and forced together with bolts and then fastened with rivets.

The Welding Process.

The welding process consists of Joining two plates by butt welding the edges. When finished, the Joint will be seamless and will have throughout the plate a uniform thickness. In heating a welded fire box, the water will protect the sheet on its entire surface. It eliminates fire cracks, steam burnt plates and corking. It decreases the coal consumption and increases steam generation.

In some railroad fields, the application of welded fire boxes is an established factor; but in commercial fields the confidence in welded fire boxes is not complete. A railroad shop

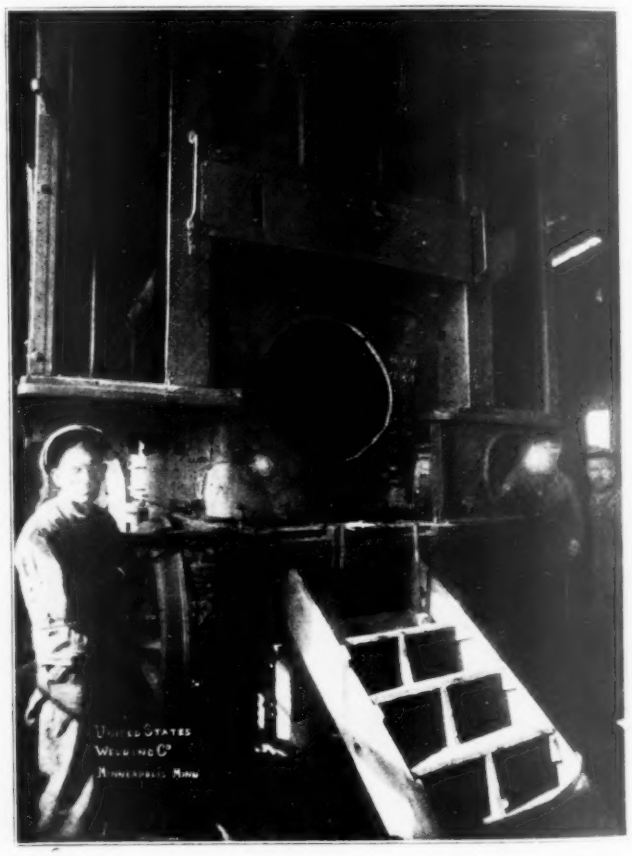


Fig. 2.

that has a few hundred locomotives, can experiment and develop men to its use; and when convinced of its superiority it will adopt the welding as a standard operation. Not so, however, with the commercial firm that has one or more boilers or the farmer with his threshing engine. They did not have the opportunity to study the advantages or adaptability of a welded seam in a fire box. Nor are the majority of our welders capable of welding boilers, for two reasons: First they lack the knowledge of proper steel welding; second, they do not understand boiler construction. However, greater confidence in welded fire boxes, in the commercial field, will be inspired by an increased proficiency of our welders. And, as we live in a progressive age, it is the writer's conviction that our commercial welders will invade this field in the near future intelligently and successfully.

*United States Welding Co.

LOOK OUT

for

1. **Efficiency in operation**
2. **Cost of operation**
3. **Speed in welding**
4. **Degree of certainty of uninterrupted service.**

Primary requisites of welding apparatus and you have the

"ZEUS"

then add LOW INITIAL COST.

Is this suggestion worth only the time it takes to read it or are you interested n details?

EXCLUSIVE TERRITORY is now being apportioned. We have given preference to the wide awake dealers of gas apparatus who have seen the arc as the inevitable master of the welding field, because acquaintance in the field plus the knowledge of the arc as the "ultimate welding medium" assures orders. We do not, however, limit ourselves in this regard.

GIBB INSTRUMENT COMPANY

1644 Woodward Avenue, Detroit, Mich.

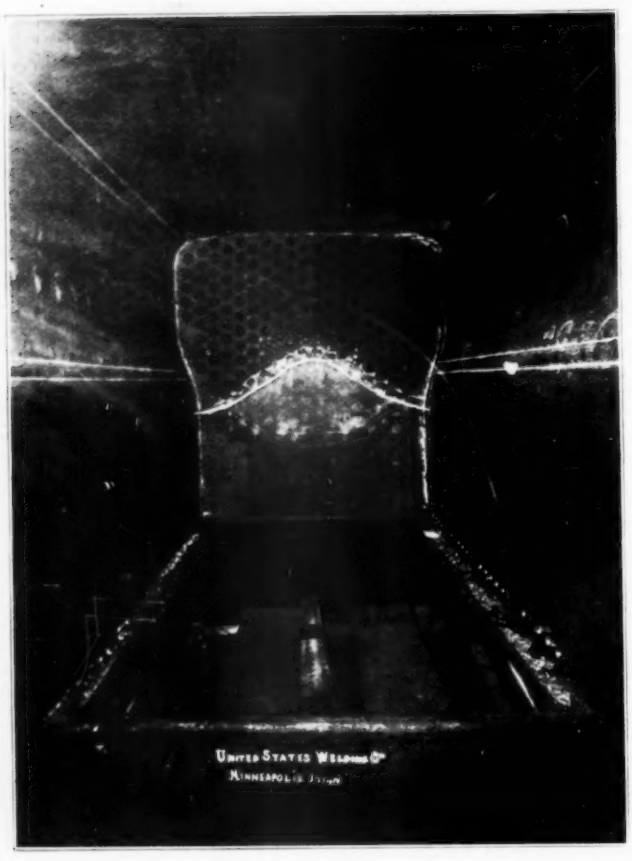


Fig. 3.

Method of Welding.

The first operation necessary is to cut all rivet heads from the mud ring and to drive out the stubs. Then replace the same size bolts about every 10th hole at the mud ring, so as to keep mud ring and the outside sheets lined up. Then cut out all stay bolts, beginning from the crown sheet down to the mud ring.

Figure one (1) shows a locomotive fire box all cut out with the oxy-acetylene process, before welding. The two upper side sheets and upper rear flue sheet were left in place because they were in good condition. Cutting off the sheets was performed in the following order:

1. Two lower side sheets as per figure 1
2. Lower flue sheet as per figure 1.
3. Door sheet as per figure 1.
4. Crown sheet as per figure 1.
5. Two corner patches on outside back sheet. Figure 2.
6. Door collar on back sheet. Figure 2.
7. Stay bolts stubs cut out as shown in figure 1, right side.

Fig. 4.

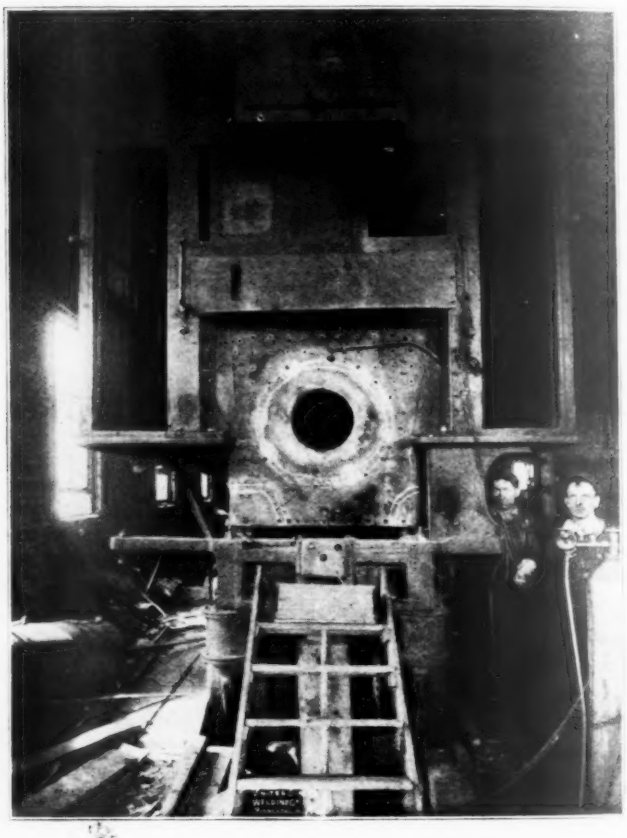


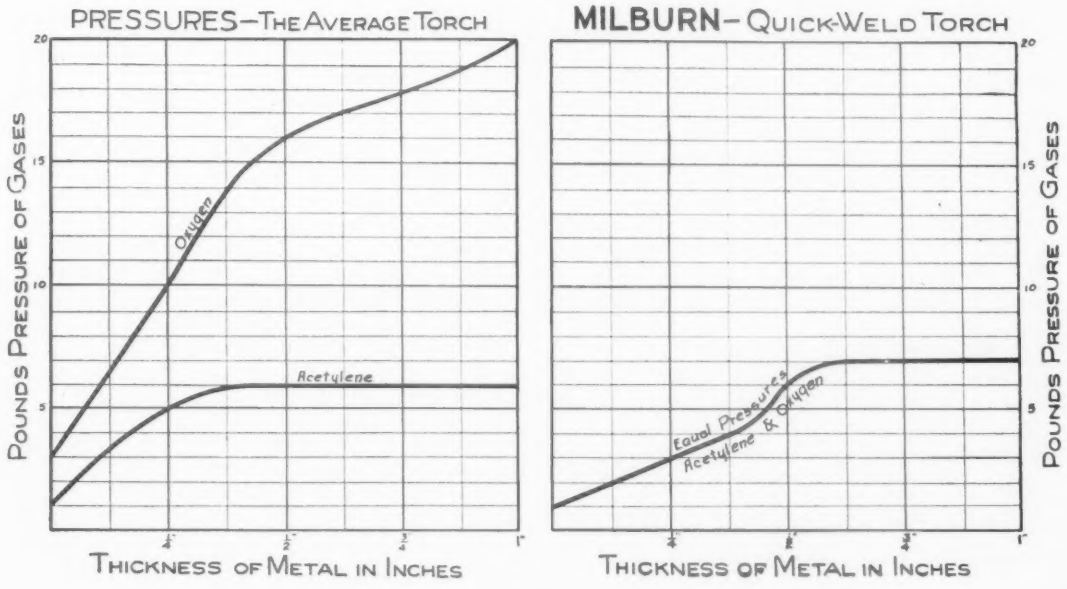
Fig. 5.

The next operation was to cut, flange and bevel the new sheets and to weld them in the following order:

1. Crown sheet welded to the two old side sheets as per figures 3 and 4.
2. Lower side sheets welded to the upper sheets as per figures 3 and 4.
3. Upper old flue sheet welded to crown and side sheets as per figure 3.
4. Lower flue sheet welded to upper flue sheet and both side sheets as per figure 3.
5. Door sheet welded to crown and side sheets as per figure 4.
6. Door collar welded to the outside back sheet as per figure 5.
7. Two patches welded at the mud ring corners to outside back sheet, as per figure 5.
8. Circular Joint at the fire door butt welded, thus welding the door sheet with the back head sheet, as per figure 5.

Figures 3 and 4 represent a complete welded fire box minus rivets and it is very much appreciated by the owner of the locomotive.

Welds on Equal Pressure



The MILBURN QUICK-WELD Torch

Combines the greatest economy of operation with the elimination of all danger of oxydizing the metal through an over-supply of oxygen, a danger so common to other types of torches. As shown on the charts, the amount of oxygen on heavy welding is half that demanded by the old-style torches. The QUICK-WELD torch is equally efficient on either heavy or light welding and its simple and sturdy construction enables it to withstand the roughest usage.

For economy and satisfaction in welding write for booklet No. 35 or send for a QUICK-WELD on approval.

MILBURN acetylene lights are the standard for construction, mining, railway and shop. Write for booklet No. 25.

THE ALEXANDER MILBURN COMPANY - BALTIMORE, MD

MILBURN *Welding and Cutting Torches are covered by U.S. Patents and the Alexander Milburn Company guarantees full protection to vendors and users of its products.*

New York 51 E. 42nd Street.
Chicago 1012 Kimball Bldg.
Pittsburgh 406 Bessemer Bldg.
San Francisco 1037 Monadnock Bldg.

Agencies throughout the United States and Canada.

ATLANTIC CITY EXHIBITS.

Included among the exhibitors at the Railway Supply Manufacturers' Association Exhibit at Atlantic City this year were the following members of the welding trade:

Air Reduction Sales Company, New York, N. Y.—Oxy-acetylene apparatus and gases. Represented by A. R. Ludlow, A. S. Kinsey, C. D. Trout, L. A. Warfel, H. F. Weldin, R. T. Peabody, and E. L. Mills.

Bastian-Blessing Company, The Chicago, Ill.—Rego welding and cutting apparatus. Represented by W. S. Hartsock, F. R. Goehler, H. H. Hirshon, W. H. Girdler and C. W. Davis.

Carbic Manufacturing Company, Duluth, Minn.—Carbic cakes; portable acetylene lights and generators; oxy-acetylene welding and cutting equipment. Represented by D. C. Duncan, G. B. Van Buren, W. H. Norden and M. V. Crouse.

Electric Arc Cutting & Welding Company, Newark, N. J.—Welders; hoods; electrode handles; electrodes. Represented by W. J. Murray.

General Electric Company, Schenectady, N. Y.—Electric welding equipments. Actual demonstration of the electric welding equipment carried on throughout the Convention. Represented by W. J. Clark, Charles Fair, R. E. Woolley, C. A. Raymond, J. J. Liles, C. K. West, G. H. Gilbert, R. G. Standerwick, B. C. Tracy, R. E. Moore, C. H. Williams, H. W. Stewart, P. O. Noble, John Roberts, F. P. Jones, J. F. Myrick, F. S. Hartman, P. A. Dyer, W. L. Merrill, J. A. Seede, J. M. Hollister, J. W. Ham, C. Dorticos, D. B. Rushmore, B. S. Pero, John Eaton, R. S. Bennett, D. K. Frost, C. F. Lawrence and L. W. Shugg.

Hauck Manufacturing Company, Brooklyn, N. Y.—Portable heaters; pre-heating burners; crude oil furnace burners; kerosene torches; melting furnaces; oil burners. Represented by John D. Moore, G. A. Nelson, J. R. Jarvis, G. N. Broadhurst and Arthur E. Hauck.

MacLeod Company, The, Cincinnati, Ohio.—Flue welding apparatus; portable oil burners. Represented by Walter MacLeod and A. H. Schmidt.

Metal & Thermit Corporation, New York, N. Y.—Thermit and appliances; sample welds; samples of carbonfree metals and alloys produced by the Thermit process; large sample weld on a 9-inch crankshaft; materials for demonstration pipe welding for the purpose of welding locomotive superheater units; sample of superheated unit so welded. Represented by F. W. Cohen, W. R. Hulbert, H. D. Kelley, H. S. Mann, E. B. Bloom, J. G. McCarty and W. Aldrich.

Milburn Company, The Alexander, Baltimore, Md.—Milburn acetylene generators; cut-weld combination torch; cutting torch; Milburn equal pressure welding torch; portable carbide lights. Represented by A. F. Jenkins and C. R. Pollard.

Oxweld Railroad Service Company, The, Chicago, Ill.—Reception booth. Represented by H. W. Jacobs, R. R. Browning, E. S. Richardson, J. P. Furbeck, William Leighton, George Thompson, C. B. Moore, M. C. Beymer, J. P. McWilliams, H. W. Schulze and G. M. Crownover.

Page Steel and Wire Company, New York, N. Y.—Armco iron electric welding wire; Armco iron oxy-actylene welding wire and "Copperweld" copper clad steel wire. Represented by W. T. Kyle, C. A. McCune, G. A. Paff and E. C. Sattley.

Safety Car Heating & Lighting Company, The, New York, N. Y.—Oxy-Pintsch metal cutting equipment. Represented by W. L. Conwell, J. A. Dixon, A. C. Moore, W. L. Garland, George E. Hulse, L. Schepmoes, H. K. Williams, R. H. Haarvey, J. H. Rodger, H. D. Donnell, V. S. Henry and J. S. Henry.

Strong-Kennard & Nutt Company, The, Cleveland, Ohio.—Safety devices in the form of clothing, surgical appliances, goggles, eye protectors and masks. Represented by B. W. Nutt, Thomas P. Scully, J. H. Hopper and F. B. Frank.

U. S. Light & Heat Corporation, Niagara Falls, N. Y.—Direct current arc welder converter; alternating current arc welding motor generator. Represented by W. L. Bliss, H. A. Matthews, R. H. Van Nest, R. Bauer and W. B. Turlington.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—Arc welding motor-generator. Represented by [illegible] McQuiston, J. C. Bair, J. Andrews, J. A. Albercht, W. [illegible]ehan, C. M. Harris, F. O. Kirkpatrick, H. C. Mode, R. [illegible], W. H. Patterson, Charles Rabbons, R. J. Ross, H. [illegible] and E. W. Wise.

Wilson Welder & Metals Company, Inc., New York, N. Y.—Wilson plastic-arc welder. Represented by J. O. Smith, R. S. Drummond and Claude Hartford.

INSTRUCTIONS TO SURVEYORS*

Repairs to Boilers by the Electric or Oxy-Acetylene Processes.

The repairing of the boilers of passenger steamers by the above processes has been tentatively in operation for a considerable period; and, in view of the experience gained, the surveyors are informed that, provided the work is carried out to their satisfaction by experienced workmen, these processes may be employed, within limits, for repairing cracks in furnaces, combustion chambers, and end plates of boilers, and in the same parts for reinforcing the landing edges of leaky riveted seams which have become reduced by repeated chipping and caulking.

In some old furnaces which have been repaired by the above processes, it has been found that, after a few months' working, cracks have again developed at parts adjacent to those welded, probably owing to the original material of the furnace having become fatigued and worn out by long and severe usage. In dealing with old furnaces, therefore, this fact should be taken into consideration.

It has also been brought to the notice of the board of trade that a shell plate of a cylindrical marine boiler cracked recently through a solid part where some surface welding had been done by the electrical process two years ago. The welding had extended for a length of about 12 inches along the outside caulking edge of one of the middle circumferential seams at the bottom of the boiler, the leaky edge of the seam and the adjoining shell plate having been covered (soldered) by metal deposited by this process in the usual way. The shell plate was 1 5/32 inches thick, and the crack, which followed the line of surface welding, extended in a circumferential direction for a distance of 2 feet 9 inches, the welded part being situated midway along the crack.

For the present, it is not proposed to prohibit, within limits, the reinforcing of the circumferential seams of boiler shells at the end plates are well stayed, but no welding should be done to these parts by any process which may cause local heating over an appreciable area of the plate such as the oxy-acetylene, oxy-hydrogen or other similar method.

In no circumstances should any part of a boiler of a passenger vessel be welded if wholly in tension under working conditions, such as a stay or the shell plate at a longitudinal seam, the failure of which by cracking at the welded part might lead to disastrous results.

In any case in which the proposed repairs to the boilers of passenger vessels by either of the above processes are of an uncommon or unusually extensive character, the particulars should be submitted for the board's consideration and approval.

After repairs by welding have been completed, the parts at or adjacent to the welds should in all cases be well hammer-tested; and, unless the welding is of a trifling character, a hydraulic test of not less than one and a half times the working pressure should be applied to the boiler after the hammer-testing has been effected.

This supersedes Circular 1532, dated April, 1913, which is hereby cancelled.

C. Hipwood, Assistant Secretary.

*Issued by the Board of Trade, Marine Dept., London, England.

Electrolytic Oxygen

For cutting and welding operations it is of paramount importance to have oxygen of highest purity, free from inert elements.

Electrolytic Oxygen produced today is 99.5% pure or better and the remaining element is pure hydrogen, an active element which is consumed in the heating flame and in no way retards efficiency.

Tests carried out and reported by J. M. Morehead, late Chairman of the Oxygen Section of the War Industries Board, led him to the following conclusion, expressed before the New York Railroad Club:

> "In cutting it is quite essential that oxygen be pure and if any appreciable amount of nitrogen is present, this nitrogen expands with the heat and prevents the acetylene from entering the slot. This results in a wide kerf and unsatisfactory work, while at the same time the amount of oxygen necessary for any given work increases enormously."

M. Amadeo, the well-known technical director of the Union de la Soudure Autogene, Paris, as the result of a long series of cutting tests, reported to the International Acetylene Congress at Rome as follows:

> "The presence of nitrogen in the oxygen manifests itself by a considerable showing up of the operation and the lessening of the penetrative power of the stream of oxygen.
>
> "The loss of speed of the cut for thicknesses from 10 to 30 mm. is proportionate to the amount of nitrogen contained.
>
> "Nitrogen magnifies the effect of scales and blow-holes and increases the changes in the metal which are made by the heating flame along the line of the cut—
>
> "Hydrogen in small quantities has no influence whatever upon the cutting operations."

For Economy and Efficiency use only electrolytic oxygen.

Purchase it at service stations from the following manufacturers:

CALIFORNIA
California Burdett Oxygen Co., Los Angeles.
California Burdett Oxygen Co., Oakland.

COLORADO
Burdett Oxygen Co., Denver.

ILLINOIS
National Oxygen Company, Chicago.
Acme Oxygen Company, Chicago.
Burdett Oxygen & Hydrogen Co., Chicago.
Swift & Company, Chicago.

INDIANA
Indiana Oxygen Company, Indianapolis.
Logansport Oxygen Company, Logansport.

IOWA
Bettendorf Oxygen Hydrogen Co., Bettendorf.

KENTUCKY
Kentucky Oxygen & Hydrogen Co., Louisville.

MICHIGAN
Michigan Ox-Hydric Company, Muskegon.
National Oxygen Company, Detroit.
Burdett Oxygen Co. of Detroit, Detroit.

MISSOURI
Oxygen Gas Company, Kansas City. (Two plants in Kansas City.)
St. Louis Oxygen Company, St. Louis.

MONTANA
Mountaineer Welders Supply Co., Butte.

NEBRASKA
Balbach Oxygen & Hydrogen Co., Omaha.

NEW YORK
Standard Oxygen Company, New York City.
International Oxygen Company, College Point, L. I.

NEW JERSEY
International Oxygen Company, Newark.
Standard Oxygen Co., Hoboken.

OHIO
Burdett Oxygen Co. of Cleveland, Cleveland.
Ohio Chemical & Mfg. Company, Cleveland.
Dayton Oxygen & Hydrogen Products Co., Dayton.
Ohio Electrolytic Oxygen Company, Cincinnati.

OKLAHOMA
Burdett Oxygen Co. of Oklahoma, Oklahoma City.

OREGON
Portland Oxygen & Hydrogen Co., Portland.

PENNSYLVANIA
International Oxygen Company, Verona.
Burdett Oxygen Co., Philadelphia. (Plants at Chester and Norristown, Pa.)
Burdett Oxygen & Hydrogen Company, Pittsburgh.

TENNESSEE
Burdett Oxygen Co., Chattanooga.

TEXAS
Burdett Oxygen Co. of Texas, Ft. Worth.
Magnolia Gas Products Co., Houston.

UTAH
Whitmore Oxygen Company, Salt Lake City.
Utah Burdett Oxygen Company, Salt Lake City.

WASHINGTON
Washington Burdett Oxygen Co., Seattle.

WISCONSIN
Universal Oxygen Company, Sheboygan.

Gas Products Association, Chicago, Illinois

801 Marquette Building

WELDING TRUCK SIDE FRAMES, BOLSTERS AND ARCH BARS*

The committee made a report to the 1918 convention; however, it was omitted from the proceedings and the committee was requested to continue its researches and report again this year.

The Committee on Standards also referred to this committee the following from I. S. Downing, general master car builder, C. C. C. & St. L., which was received in reply to the Circular of Inquiry from the Committee on Standards: "It is our opinion that a limit should be placed on the welding and reclaiming of various parts, such as couplers, side frames, etc., inasmuch as at the present time there is nothing definite as to what extent broken or cracked couples, side frames, and the like, can be welded and placed back in service. This practice would eliminate any possibility of relying on the judgment of one man as to whether or not the part in question would be serviceable after being repaired."

Prior to the 1918 Convention the committee conducted static tests at the Bettendorf Company's plant, Bettendorf, Iowa, and at the American Steel Foundries' plant, Alliance, Ohio, on cast steel truck side frames and cast steel bolsters, some of which had been autogenously welded, whereas others were tested with cracks not welded. The results were variable; some of the frames and bolsters which had been welded failed at a point other than where the weld was located and in other cases the failure was through the weld. It also developed that some of the welds proved to be of inferior quality upon examination of the fracture.

The fact that so many cast steel side frames and cast steel bolsters are failing in the tension members in conclusive evidence of weakness in design and the welding of the fractures will not add to the strength but is likely to introduce a condition of further weakness by improper workmanship and change in the structure of the metal. It is, therefore, necessary to confine autogenous welding within specified limits on structures subject to alternating stresses and prescribe definite instructions to govern such welding.

The necessity for a greater factor of safety in the design of cast steel truck side frames and steel bolsters has been recognized by the association in the adoption of specifications including chemical properties, of load tests and limiting weights for cast steel truck side frames, as well as specifications including definite designs, limiting weights, chemical analysis and physical tests of the steel for both pressed steel and cast steel bolsters; and the United States Railroad Administration adopted definite designs of cast steel truck frames and bolsters based on those specifications and also prescribed that when renewals are necessary on existing cars side frames and bolsters in accordance with these standards be used.

It is, therefore, desirable from the standpoint of economy and safety to retire cast steel truck sides and bolsters not conforming to these specifications, as rapidly as they show signs of failure; however, it is realized that this would entail a large expenditure of money and, therefore, the committee believes that as an expedient autogenous welding should be permitted on these members within well defined limits and regulations.

Other metal car parts subject to compression only or to compression and low tension stresses may be welded. Worn surfaces of any nature and on any parts may be built up, provided that the material remaining in parts subject to high tension, such as hangers, etc., before welding is equal to at least 80 per cent of the original section area, and in parts such as bolster guides, column castings, center plate rings, etc., the material remaining must be equal to 60 per cent of the original section area.

Broken coupler bodies, knuckles, locks, lifters and throwers should not be welded for the reason that reinforcing of the fractures cannot be permitted on account of interfering with the proper operation of the parts. Worn coupler bodies, knuckles, locks and throwers may be built up to the original sections, dressed and checked with proper gages to insure interchangeability and proper operation.

In order to determine what results would be obtained with blacksmith welding of wrought iron arch bars, four full sized pieces of 5 in. by 1¼ in. arch bar material were welded by competent blacksmiths and these were tested (pull test) full size in comparison with four other bars which had not been welded. The following results were obtained:

	Lbs. Per Sq. In. Ultimate Strength	Elongation Per Cent in Eight Inches
Welded bar	34,170	
Welded bar	29,580	
Welded bar	37,200	
Welded bar	35,140	
Unwelded bar	46,270	
Unwelded bar	45,250	
Unwelded bar	46,360	
Unwelded bar	46,260	

The average tensile strength shown by the unwelded bars was 46,000 lb. and the strength of the welded bars varies from 64 per cent to 81 per of this average, with very low elongation in eight inches. The general average of the strength of the welded bars gives 74 per cent of the average of the unwelded material. No attempt was made by the smith shop to produce a special weld but the material was handled as would be done for any ordinary welding of this character and the figures probably represent what may be expected under ordinary conditions.

It is a simple process to form and drill arch bars and as the failure of this imoprtant member of truck construction is a serious matter, the committee is not justified in approving any process of welding which will decrease the strength of the original bar.

The committee, therefore, recommends the following:

Autogenous Welding, Limits and Regulations

I. General.—In welding, either by the use of gas or electricity, car and good judgment on the part of the operator are of prime importance. The operator's ability as to the desired proficiency should be certified by the mechanical officers in charge or by an instructor qualified by experience in general railroad welding with the method involved.

The metal added is liable to be porous and relatively brittle. The heat at the surfaces welded affects other sections near the weld, tending to reduce strength and toughness.

The following general rules must, therefore, be carefully observed:

II. Welding cracks or fractures will not be permitted on the following: Axles, arch bars, car wheels or tires, track equalizers, spring or bolster hangers, brake staffs, brake wheels, coupler bodies, knuckles, knuckle pins, locks, lifters and throwers.

Parts made of alloy steel or heat treated carbon steel. Top chord angles of open top all steel cars if the fracture is located at a point between bolsters more than five feet from the center of either body bolster.

III. Building up worn surfaces will be permissible on the following:

Parts subject to compression only.

*Spring or bolster hangers, holes in levers.

†Center plates, truck sides, bolsters and column castings.

Journal boxes, coupler bodies, knuckles, locks, lifters and throwers. After building up to the original section, the same must be dressed and then checked with proper gages to insure interchangeability and proper operation.

Flat spots on rolled steel wheels and tires if thickness of tread is 1 in. or more above limit of wear groove.

*Provided that the material remaining in the part is equal to at least 80 per cent of the original section.

†Provided that the material remaining in the part is equal to 60 percent of the original section.

IV. Welding cracks or fractures will be permitted on the following:

Parts subject to compression only and general car parts not

*Annual report of the Welding Committee, American Railroad Association, Atlantic City, June 20th, 1919.

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Car sills, posts, braces, stakes, carlines, side plates and end plates.

Regulations for Welding

V. (a) All parts marked (*) in Section IV, except truck transoms, must not be welded unless removed from the car or truck. Truck transoms may be welded in place by removing the truck from under the car body.

(b) The edges of pieces for welding must be prepared as shown in Figs. 1 and 2. If both sides of the fractured member can be worked upon, the fracture should be prepared as per Fig. 1, and where only one side of the fractured member is accessible, Fig. 2 should be followed. The entire crack should be burned or chipped out far enough back so that there will be no portion of the crack in the metal. Failure to do this permits the check or crack to work its way across the metal to the farther side, due to the constant vibration, even after the weld has been made. A hole may be drilled at the end of the crack or check and chipped or burned towards the hole. The surfaces where new material is to be deposited must be clean and bright and reasonably smooth and, therefore, if the surfaces are prepared by the burning process the surfaces must be finished by chipping before welding.

(c) The portion of the part adjacent to the fracture should be heated before the welding is begun. In welding, the operator should begin to weld at the point farthest away from the outside edge and work the weld towards the edge. All efforts must be made to prevent oxidization, and to accomplish this the work should be placed at an angle that will allow the blowing out of all slag or impurities in the fused metal. Giving the torch a rotary movement will assist in their removal.

(d) The new material must be deposited to the form shown in Figs. 3 or 4 in order to properly reinforce the weld, and *B* should be somewhat greater than *T*. For the important items marked (*) and (†) in Section IV, as well as for car sills, posts, braces, stakes, carlines, side plates and end plates, *B* must be at least 1½ times *T*.

(e) The parts marked (*) in Sections III and IV, with the exception of truck transoms welded in place, must be carefully annealed by uniformly heating to approximately 1,400 or 1,500 degrees F. and allowed to cool slowly in the atmosphere.

(f) Worn surfaces permitted to be built up to the original section by depositing of new metal thereon must first be made clean, bright and fairly smooth, and after the metal is deposited must be dressed to the required dimensions and gas-cut where necessary.

(g) When truck side frames and bolsters are welded the weld must be made smooth and the following record legibly stamped on the weld by at least ⅜-in. steel stencils, in the following form:

(Mo.—Day—Yr.)	(Railroad)
o——oo——oo	A. B. C.
XY	X
(Shop Abbreviation Mark)	(Welder's Identification Number or Mark)

VI. It is also recommended that reference be made in the Rules of Interchange to the effect that autogenous welding, by either gas or electric process, when performed must be strictly in accordance with these limits and regulations. The present price in the Rules of Interchange, Rule 107, Item 432, will not properly compensate the party performing the welding according to these regulations, and should be revised. A penalty should also be prescribed in the Rules of Interchange providing for the erection of any car on which a truck side frame or truck bolster is welded, after the adoption of these regulations, when not conforming to same.

The report is signed by W. O. Thompson (Chairman), New York Central; G. W. Rink, Central Railroad of New Jersey; J. T. Walls, Pennsylvania; J. J. Hennessey, Chicago, Milwaukee & St. Paul; A. M. McGill, Lehigh Valley; R. W. Schuhr, St. Louis-San Francisco; Willard Kells, Atlantic Coast Line; J. R. Gould, Chesapeake & Ohio; E. H. Sweely, Long Island and C. F. Giles, Louisville & Nashville.

During the reading of the report Mr. Thompson said: Your committee would like to have the paragraph in the middle of page 4, reading: "Flat spots on rolled steel wheels and tires, if thickness of tread is 1 in. or more above limit of wear groove," eliminated from the report, because after giving the matter further consideration we do not believe it is good practice to have that inserted.

Discussion

At the conclusion of the report Mr. Thompson said: There was a part of the report which was not printed, and that is that the thanks of this Association are due to The Bettendorf Company, The American Steel Foundries, and the Pennsylvania Railroad for placing all of their appliances at our disposal and for the considerable time and amount of money that was spent in the long extended experiments made with regard to welding.

Mr. Fuller: The committee's report has one recommendation that is all right, but I think you all ought to understand it. The last paragraph of the report reads as follows:

"A penalty should also be prescribed in the Rules of Interchange providing for the rejection of any car on which a truck side frame or truck bolster is welded, after the adoption of these regulations, when not conforming to same."

That should be carefully considered, as I presume there are

*Welding is permitted only when the area of the crack is less than 2-5, or 40 per cent, of the area through the section at the point of fracture, but it is not permissible to weld any crack located within 6 in. of an old weld.

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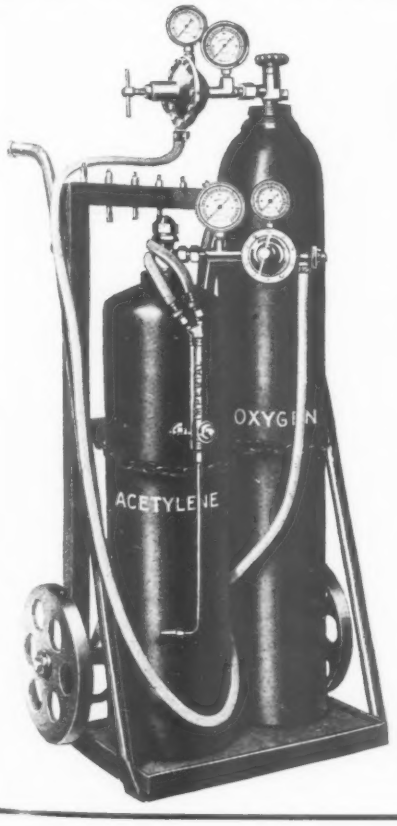

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hundreds and thousands of cars with the truck side frame or truck bolster welded, that have been welded for years, and are in use, and this paragraph may be the means of rejecting quite a number of cars.

Mr. Gaines: Mr. Fuller is right in this matter, and rather than make that penalty operative immediately, it would be better to set a future date, when the matter will become effective, so that we can gradually eliminate these cars. I would like to ask why the committee desires to cut out the recommendation relative to flat spots on rolled steel wheels and tires, if thickness of tread is 1 in. or more above limit of wear groove.

Mr. Thompson: They do not stick and you have a flat wheel, which is a great deal worse than what you had before.

A. W. Gibbs: I would like to ask, in connection with Section IV, on page 4, why it is stated "Welding cracks or fractures will be permitted on the following: 'Parts subject to compression only and general car parts not subject to high tension strains except as otherwise prohibited."

Why is the welding of bolsters and truck frames confined to the compression members only?

Mr. Thompson: It is hard to define what the tension and compression is in truck sides and bolsters. There are times when they are in tension and other times when they are in compression. It would be hard for anyone to say what are the tension members and what are the compression members in these two parts.

W. J. Tullerton (Rock Island): In welding these flat spots on rolled steel wheels and tires, did you use the electric process as well, and did you have the same difficulty with the welds giving out when you used the electric weld? It is a well-known fact, that you cannot use the acetylene process for this purpose, as well as the electric process, for the reason that the acetylene calls for pre-heating, which the electric process does not. I think it is a mistake to condemn the welding up of flat spots on rolled steel wheels and steel tired wheels, until we know the reasons.

Mr. Thompson: Both processes were tried, and we could see no difference between the two in the result.

John A. Pilcher (N. & W.): I wish to point out in Paragraph 4, the first statement, as follows:

"The fact that so many cast steel side frames and cast steel bolsters are failing in the tension members is conclusive evidence of weakness in design, and the welding of the fractures will not add to the strength, but is likely to introduce a condition of further weakness by improper workmanship and change in the structure of the metal."

There are exceptions to that, because the stresses in the side frames can be very much increased by improper spring capacity; that is, any roughness in the track transmitted to the spring cause stresses to be set up which are indefinite, so there is a possibility of improper spring design affecting the breakage of the side frames, irrespective of the weakness of the casting. I want to take exception to that particular paragraph, because the spring must be properly designed to take care of the load, to avoid the breakage of the side frames.

There is another thing to which I desire to call attention. Under heading III—"Building up worn surfaces will be permissible on the following:" I notice they do not mention the building up of collars on axles. This is a source of great saving, and where the collars are built up simply to prevent their excessive lateral movement, it will not materially affect the strength of the axle, because the stresses are immaterial at that point. I wonder if that feature cannot be introduced—the building up of collars on axles.

Mr. Thompson: The committee did not consider the question of the building up of axles, but it is a question if that would not be in the same category as the steel-tired wheels would be. That is something, as I said before, that we did not look into.

The fact that so many cast steel side frames and cast steel bolsters are failing in tension members is conclusive evidence of weakness of design. When you consider the way the side frames are breaking down and the results we are experiencing from their breaking down I do not believe that we could arrive at any other conclusion. Conditions have changed greatly since these truck side frames and bolsters were designed. The roads are carrying heavier loads and the service is more severe, all tending to the conclusion that the side frames were not designed for the service they are giving at the present time.

Mr. Gaines: I hope before the report of the committee is printed they will include the building up of collars on axles, as it will save many axles that now have to be thrown out. As to the building up of tires, I believe if you used the electric arc and the weld is made properly, that it can be done, and before we turn that proposition down finally it should be tested out further, because you can save money by welding up spots in the wheels by that process.

John McMullen (Erie): We have had a good deal of experience in electric welding flat spots on wheels. We have welded cast steel wheels and rolled steel wheels, and used them under our passenger cars, where we could see them and follow them up, and the results obtained have been very satisfactory. If the flat spot is properly cleaned off and cut in around the edges, and the weld is then made, rather than to apply it right on top, I do not think we will have any trouble with the electric welding process.

We have built up the collars and reclaimed a great many axles. The price of axles to-day is such that I think we are justified in building up these collars. We have reclaimed many couplers, and I think if there is a slight crack down the back wall of the coupler it can be satisfactorily welded and reclaimed.

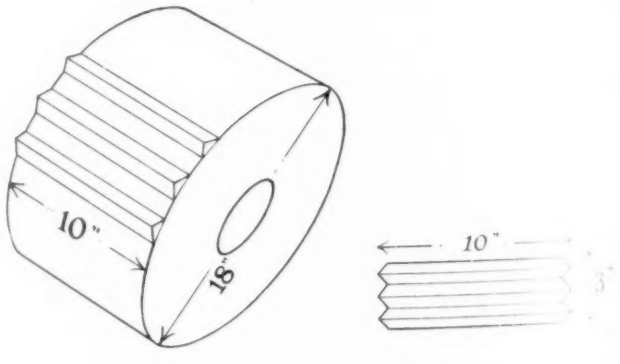
BUILDING UP TEETH

Editor:

I am sending you some drawings.

The first proposition is to weld teeth in a gear of any considerable size. Of course, a gear of this size given or larger should be preheated before the torch is applied at all.

The easiest way to build new teeth is to take some one-half inch rods and place them on a welding table, side by side, having the rods the exact length that you desire the teeth in the gear to be. Weld enough of these rods together to give you the height of the tooth from the rim of the wheel to the top edge



of the new tooth to a level, weld on top of it enough to cover one side of the tooth. Then turn the wheel so that the other side of the same tooth is on a level and proceed as with the first of the tooth. Place the welded rods edgeways in the center of the place where the tooth is missing and weld it there. Then turning the wheel to a position so that you can bring the side other side until you have an exact sized tooth. Proceed the same way with any large gear. (The drawing included may be of some value to you.)

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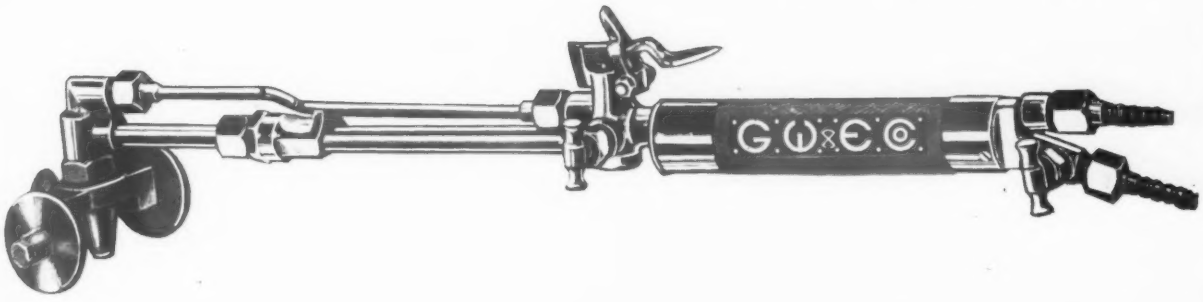

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The second proposition to weld is a large heating kettle or retort used in making sulphur chloride. The diagram enclosed will probably explain that the kettle was cracked half its circumference just below the three-inch flange which holds this kettle to its other half. The space marked water jacket is heated by steam under pressure. The idea is to weld this kettle without preheating. We took a hack-saw and cut the three-inch flange and allowed the expansion to work ahead of us. We started welding at the joint directly opposite where we hack-

sawed the flange or at the other end of the crack and welded to the hack-sawed joint and last of all welded the flange again. This kettle was put back into use and gave excellent proof of what can be done.

Most of us have learned to preheat everything and I believe this habit is just as disastrous and costly as not preheating anything. In some cases a single bit of heat improperly applied, causes enough cracks to take an expert a month to correct. We must learn to weld without preheating. It saves gas and time sometimes, but on other occasions, it costs more than the value it gives you.

The thing for a welder to study is "when to and where not to preheat" and use enough gray matter in the essence of common sense to pull him through and he can weld anything without any fear of after results.

John J. Foles.

WELDING LOCOMOTIVE WHEELS

Editor:

On page 29 of your May issue, Mr. J. R. Brant described an interesting job, consisting of the removal of a broken locomotive driving wheel pin, 7¼ inches long by 7¾ inches diameter, by means of the cutting blowpipe. Mr. Brant attributed the success of this job to the fact that the oxy-hydrogen process was employed instead of the oxy-acetylene process. His conclusions are not in accordance with the experience of myself and others who have done similar cutting work with Oxweld oxy-acetylene blowpipes. If the oxy-hydrogen flame could complete the cut, it stands to reason that the oxy-acetylene flame, which has a very much higher temperature, could do likewise and in less time.

"The difficulty encountered in removing this pin," said Mr. Brant, "was the fact that all the slag and molten metal had to flow out of the side the operator was working on, which is a very severe test for any cutting torch." This statement evidently applies to the preliminary cut through the center of the pin, for after penetrating the full depth of the metal an outlet for the molten slag is provided on the opposite side. This enables the operator to make the final annular cut without encountering any difficulty from a return flow of molten material.

The preliminary cut should be a tapering hole made by moving the flame in circles, or rather in a spiral path, thereby cutting out the metal much the same as one might core an apple with a knife. By following this procedure and, of course, using a blowpipe of reliable make, operating with suitable tip and under proper pressure, an oxy-acetylene blowpipe will be found to give unexcelled results, in both cost and workmanship.

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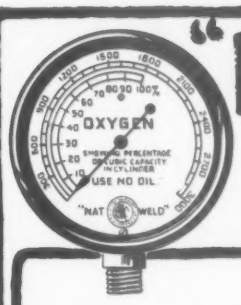

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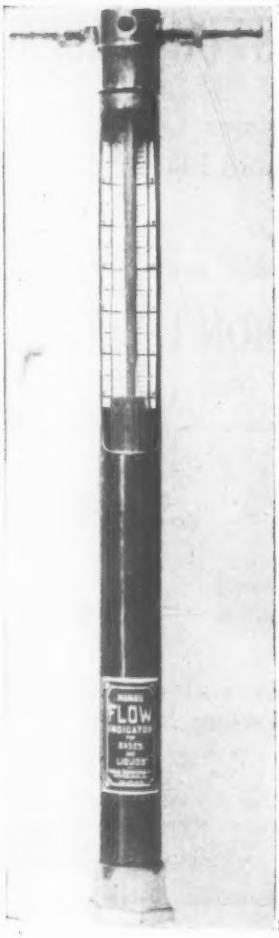

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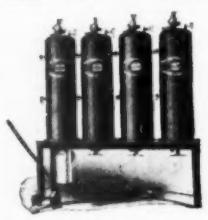

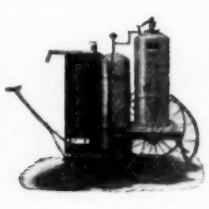

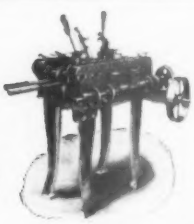

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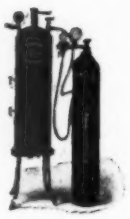

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